National Water Conditions

UNITED STATES
Department of the Interior
Geological Survey

CANADA
Department of the Environment
Water Resources Branch

AUGUST 1991

STREAMFLOW DURING AUGUST

On August 11-12, glacial-outburst flood occurred at Alaska's Strandline Lake, about 70 miles west of Anchorage. Hurricane Bob brought rains to some parts of the northeastern United States and southeastern Canada, easing some symptoms of drought, but caused no significant floods. Drought continued to affect widely separated areas as California streamflow, reservoir contents, and ground-water levels, and also New York City reservoir system contents remained well-below seasonal averages, and an all-time low occurred on a Kansas river .

Streamflow was in the normal to above-normal range at 75 percent of the index stations in the United States, southern Canada, and Puerto Rico and below-normal range streamflow occurred in 22 percent of the area of the conterminous United States and southern Canada. Total flow for the index stations in the conterminous United States and southern Canada was 11 percent above median, despite decreasing by 27 percent from last month.

The combined flow of the 3 largest rivers in the lower 48 States—Mississippi, St. Lawrence, and Columbia—averaged 5 percent below median and in the normal range, despite a 32 percent decrease in flow from July to August.

Month-end index reservoir contents were in the below-average range at 34 of 99 sites compared with 37 of 100 sites at the end of July. Contents were in the above-average range at 31 reservoirs compared with 32 last month.

Mean August elevations at four master gages on the Great Lakes (provisional National Ocean Service data) were in the normal range, but also below median, on all of the lakes.

Utah's Great Salt Lake finished the month at 4,202.70 feet above National Geodetic Vertical Datum. On August 15, lake level was 0.3 foot below the November 1990 low, but rose 0.8 foot by August 31.

Streamflow was above median in the Atlantic Slope, Florida and Gulf of Mexico, Upper Mississippi River, Southern Great Plains and Rio Grande, and Pacific Slope basins. August streamflow increased from that for July in the St. Lawrence River, Atlantic slope, Upper Mississippi River, and Southern Great Plains and Rio Grande basins.

SURFACE-WATER CONDITIONS DURING AUGUST 1991

On August 11-12, a glacial-outburst flood occurred at Alaska's Strandline Lake, about 70 miles west of Anchorage. Strandline Lake is dammed by the Triumvirate Glacier, which originates in the Tordrillo Mountains that include Mt. Spurr. Outbursts from Strandline Lake occur approximately every 1 to 5 years. Previous outbursts have occurred when the Triumvirate Glacier was floated by the lake.

Streamflow generally declined seasonally at most index stations during August, with notable exceptions occurring only in parts of New Brunswick, New England, Virginia, the Carolinas, Florida, Georgia, Texas, New Mexico, and Hawaii. Hurricane Bob brought rains to some parts of the northeastern United States and southeastern Canada, easing some symptoms of drought (eight July lows occurred at streamflow index stations in Maine, Quebec, Ontario, and Nova Scotia), but no significant floods were caused by Bob. The contents of the New York City Reservoir System continued to decline, falling from 74 percent of capacity at the end of July to 64 percent of capacity at the end of August. Below-normal range streamflow occurred in an area reaching sinuously from the Pacific Ocean to the Gulf of St. Lawrence to the south of the Great Lakes, then curving around the north side of the Great Lakes to southwestern Ontario. Three August lows and one all-time low occurred in that area. In Kansas, the August mean of 62.7 cubic feet per second (cfs) on the Little Blue River near Barnes was 1.8 cfs less than the previous all-time low of September 1980. Drought also continued to affect parts of the far West, particularly California (graphs on pages 6-7), where total streamflow, reservoir contents, and ground-water levels remained well-below average. Total streamflow for August at the six index stations in California was 25 percent below median despite heavy rains in parts of that State. The persistence and severity of the drought in California is shown by the following: (1) since the end of August 1990 (the most recent month of above-median streamflow), the cumulative streamflow deficit at the six index stations has gone from about 68 percent of a median year of runoff to about 110 percent of a median year of runoff—about 42 percent of a median year of runoff was "lost" in the last year; (2) the seasonal lows in combined storage for six large index reservoirs have generally declined steadily since 1986, bottoming out at 69, 53, 43, 45, and 33 percent of capacity, with combined storage currently at 37 percent of capacity and the beginning of winter precipitation three months away.

Streamflow was in the normal to above-normal range at 75 percent of the index stations in the United States, southern Canada, and Puerto Rico during August, compared with 72 percent of stations in those ranges during July, and 77 percent of stations in those ranges during August 1990. Below-normal range streamflow occurred in 22 percent of the area of the conterminous United States and southern Canada during August, compared with 21 percent during July, and 18 percent during August 1990. Total August flow of 473,300 cfs for the 173 reporting index stations in the conterminous United States and southern Canada was 11 percent above median, despite decreasing by 27 percent from last month, and 4 percent more than flow during August 1990. (Data for the English River at Umfreville, Ontario, were not available.)

Six new extremes—4 lows (including one all-time) and 2 highs (table on page 4)—occurred at streamflow index stations, compared with 10 new lows and 1 new high during July. The lows occurred at stations in Pennsylvania, Illinois, Quebec, and Kansas (all-time), while the two highs occurred at stations in South Carolina and northern Florida. Hydrographs for the six stations at which new extremes occurred are on page 5. The seventh hydrograph (bottom right, page 5) is for the Neches

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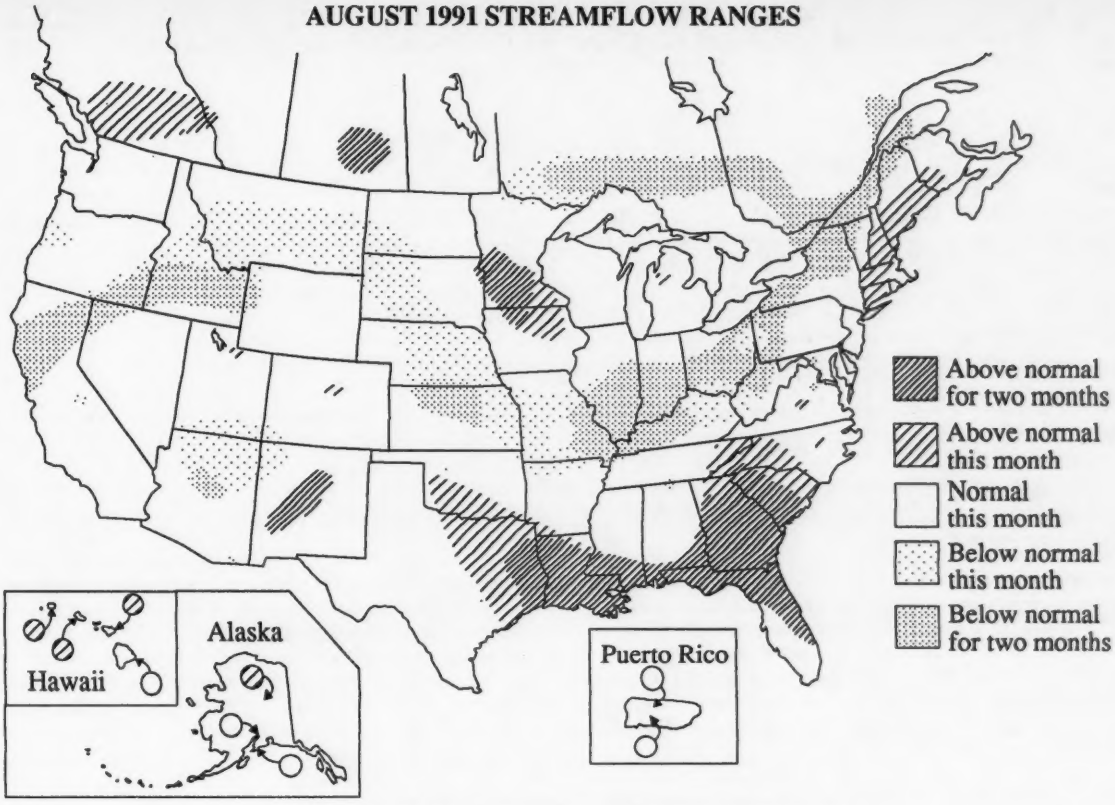
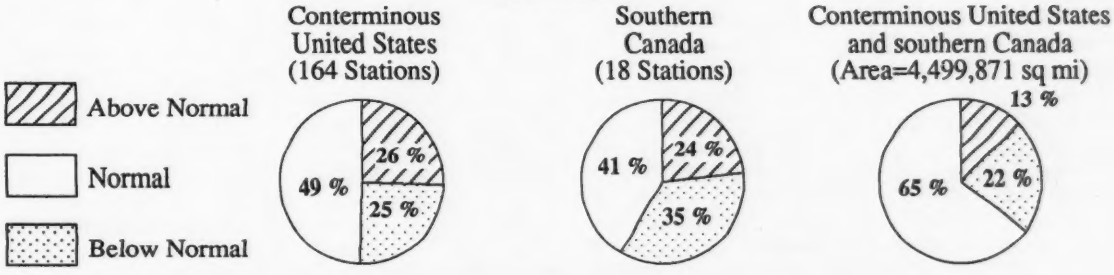
AUGUST 1991 STREAMFLOW RANGES

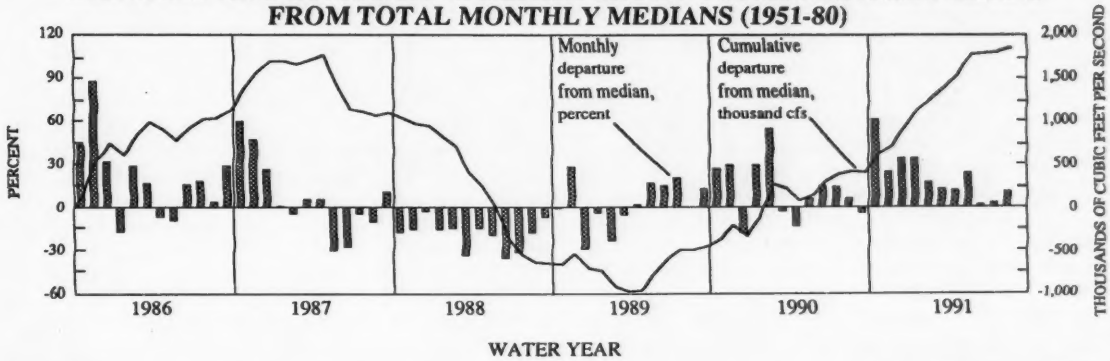


SUMMARY OF AUGUST 1991 STREAMFLOW

FLOW RANGES



MONTHLY AND CUMULATIVE DEPARTURE OF TOTAL MONTHLY MEANS FROM TOTAL MONTHLY MEDIANS (1951-80)



NEW EXTREMES DURING AUGUST 1991 AT STREAMFLOW INDEX STATIONS

Station number	Stream and place of determination	Drainage area (square miles)	Previous August extremes (period of record) Years of record	Monthly mean in cfs (year)	Daily mean in cfs (year)	August 1991 Monthly mean in cfs	Percent of median	Daily mean in cfs	Day
	LOW FLOWS								
03079000	Casselman River at Markleton, Pennsylvania	382	70	24.5 (1957)	12.0 (1930)	23.3	14	13.0	27
03380500	Skillet Fork at Wayne City, Illinois	464	73	.10 (1936)	0 (1)	.05	0	0	(1)
04130100	Coulonge River near Fort-Coulonge, Quebec, Canada	1,990	64	523 (1953)	307 (1953)	443	31	...	...
06884400	Little Blue River near Barnes, Kansas	3,324	32	96.7 (1988)	24.0 (1964)	[2]62.7	21	45.0	21
	HIGH FLOWS								
02173500	North Fork Edisto River at Orangeburg, South Carolina	683	52	1,520 (1971)	5,280 (1964)	1,667	275	3,010	3
02320500	Suwannee River at Branford, Florida	7,880	59	19,810 (1945)	22,500 (1945)	20,670	378	23,100	14

[1]Occurred more than once

[2]All-time low

River near Rockland, Texas, at which the monthly mean was 1,568 percent above median and the second highest of record for August.

The combined flow of the 3 largest rivers in the lower 48 States—Mississippi, St. Lawrence, and Columbia—averaged 699,100 cfs; 5 percent below median and in the normal range, despite a 32 percent decrease in flow from July to August. Flow of the St. Lawrence River was in the normal range for the third consecutive month. Flow of the Mississippi River was in the normal range for the second consecutive month after being in the above-normal range during May and June. Flow of the Columbia River was in the above-normal range after eight consecutive months in the normal range. Hydrographs for both the combined and individual flows of the "Big 3" are on page 8. Dissolved solids and water temperatures at four large river stations are also given on page 8. (Data for the Columbia River at Warrendale, Oregon, were not available.) Flow data for the "Big 3" and 42 other large rivers are given in the Flow of Large Rivers table on page 9.

Month-end index reservoir contents were in the below-average range (below the month-end average for the period of record by more than 5 percent of normal maximum contents) at 34 of 99 reporting sites (data were not available for the Nova Scotia system), compared with 37 of 100 at the end of July, and 32 at the end of August 1990, including most reservoirs in New York, New Jersey, Maryland, Nebraska, Idaho, Utah, Nevada, and California. Contents were in the above-average range at 31 reservoirs (compared with 32 last month), including most reservoirs in Maine, the Carolinas, Georgia, Alabama, the Tennessee Valley, Texas, and Arizona. Reservoirs with contents in the below-average range and significantly lower than last year (with normal maximum contents of at least 1,000,000 acre-feet) are: the New York City Reservoir System, New York; Allegheny, Pennsylvania; Boise River and Pend Oreille Lake, Idaho; Bear Lake, Idaho-Utah; and Clair Engle Lake and Shasta Lake, California. Four reservoirs had less than 10 percent of normal maximum contents (August average in parentheses): John Martin, Colorado, 2 percent (19); Pine Flat, California 3 percent (39); Lake Tahoe, California-Nevada, 0 percent (60); and Rye Patch, Nevada, 4 percent (57). Graphs of contents for seven reservoirs are shown on page 10 with contents for the 99 reporting reservoirs given on page 11. Maps on page 13 show reservoir storage conditions for August 1991 and August 1990 overlaid on the streamflow maps for those months.

Mean August elevations at four master gages on the Great Lakes (provisional National Ocean Service data) were in the normal range on all of the lakes, but also below median on all of the lakes. Levels fell from those for June on all the lakes except Lake Superior, on which the level remained unchanged. August levels ranged from 0.15 (Lake Huron) to 0.61 foot (Lake Ontario) lower than those for July. Monthly means have now been in the normal range for 5 months on both Lake Erie and Lake Ontario, 7 months on Lake Superior, and 15 months on Lake Huron. August 1991 levels ranged from 0.03 foot lower (Lake Ontario) to 0.38 foot higher (Lake Huron) than those for August 1990. Stage hydrographs for the master gages on Lake Superior, Lake Huron, Lake Erie, and Lake Ontario are on page 12.

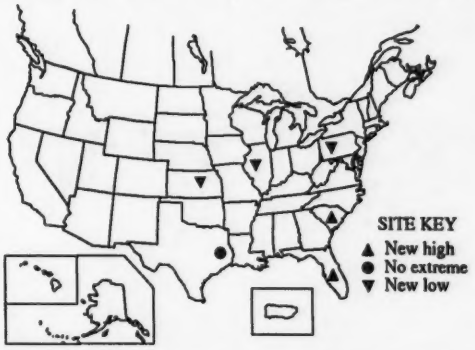
Utah's Great Salt Lake (graph on page 12) fluctuated rapidly during the month—falling 0.4 foot August 1-15 but rising 0.8 foot August 16-31—finishing the month at 4,202.70 feet above National Geodetic Vertical Datum (NGVD) on August 31. On August 15, lake level was 0.3 foot below the seasonal low of 4,202.20 feet above NGVD of 1929 which occurred on November 22, 1990. Lake level is 0.30 foot lower than at the end of August 1990, and 9.15 feet lower than the maximum of record which occurred in June 1986 and March-April 1987.

Maps on page 13 show streamflow conditions for August 1991 and August 1990. August 1991 has about the same area in the above-normal range, 22 percent more area in the below-normal range, and about 6 percent less area in the normal range than August 1990. The distribution of area in the flow ranges is quite dissimilar for the two months. Below-normal range streamflow occurred in parts of California, Oregon, Nevada, Idaho, Montana, Wyoming, Kansas, Missouri, Illinois, and Quebec during both months. Above-normal range streamflow occurred in parts of Saskatchewan, New Brunswick, Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Minnesota, South Dakota, Iowa, and Texas during both months. Both maps also show reservoir storage conditions at all index reservoir stations for comparison with streamflow.

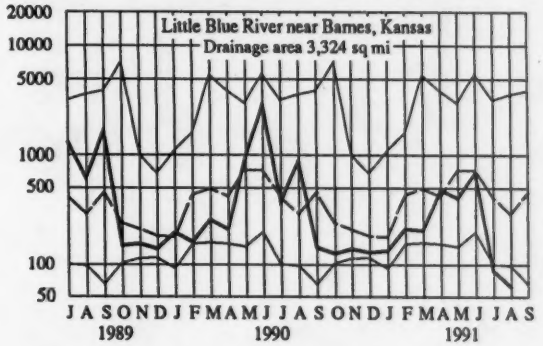
Graphs for 12 hydrologic areas show monthly percent departure of streamflow from median for the 1986-91 water years to date (page 14) and also compare monthly streamflow for the 1990 and 1991 water years with median monthly streamflow for 1951-80 (page 15). Streamflow was above median in the Atlantic Slope, Florida and Gulf of Mexico, Upper Mississippi River, Southern Great Plains and Rio Grande, and Pacific Slope basins, and below median in the other 7 basins. August streamflow declined from that for July in all areas except in the St. Lawrence River, Atlantic slope, Upper Mississippi River, and Southern Great Plains and Rio Grande basins.

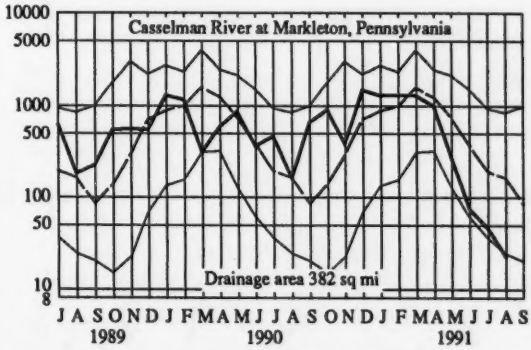
MONTHLY MEAN DISCHARGE OF SELECTED STREAMS

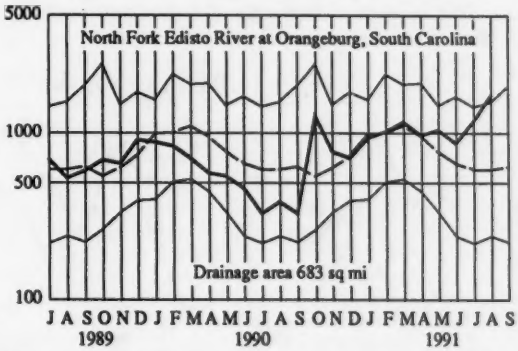
Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period.

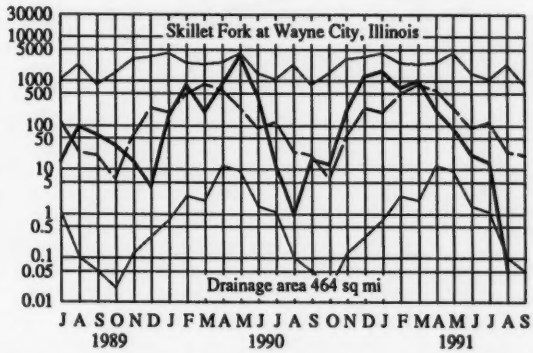


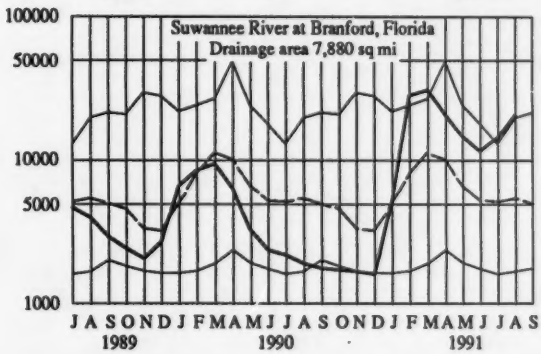
DISCHARGE IN CUBIC FEET PER SECOND

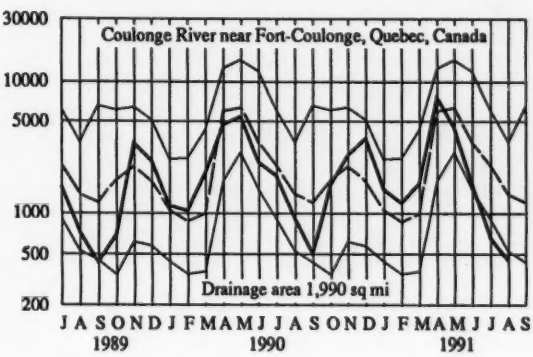


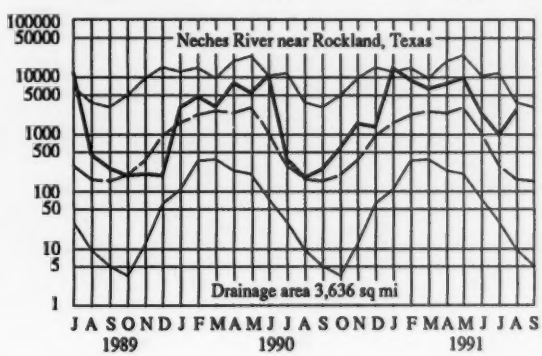



North Fork Edisto River at Orangeburg, South Carolina
Drainage area 683 sq mi
5000
1000
500
100
J A S O N D J F M A M J J A S O N D J F M A M J J A S
1989
1990
1991

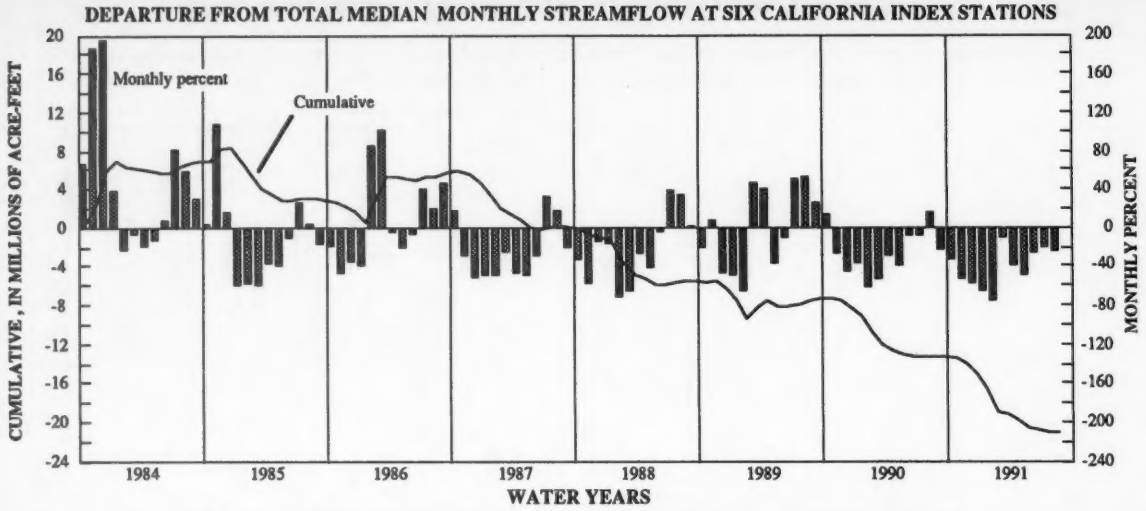



Suwannee River at Branford, Florida
Drainage area 7,880 sq mi
100000
50000
10000
5000
1000
J A S O N D J F M A M J J A S O N D J F M A M J J A S
1989
1990
1991

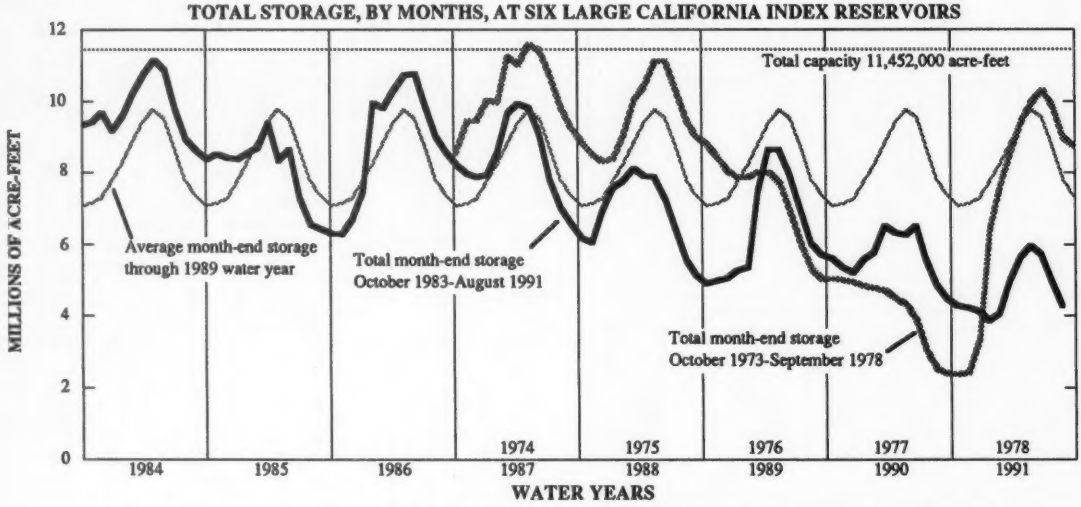




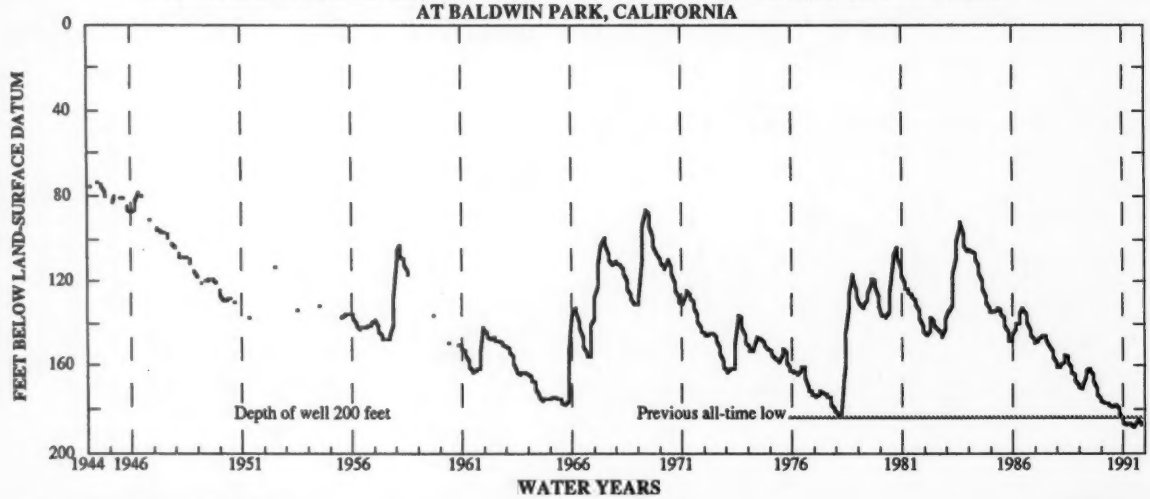
DEPARTURE FROM TOTAL MEDIAN MONTHLY STREAMFLOW AT SIX CALIFORNIA INDEX STATIONS



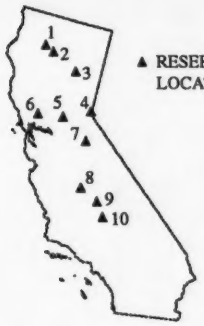
TOTAL STORAGE, BY MONTHS, AT SIX LARGE CALIFORNIA INDEX RESERVOIRS

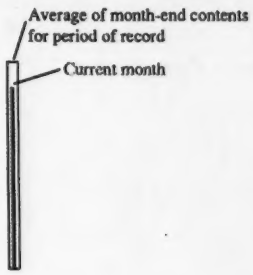


MONTH-END WATER LEVEL IN AN ALLUVIAL SAND AND GRAVEL AQUIFER INDEX WELL AT BALDWIN PARK, CALIFORNIA

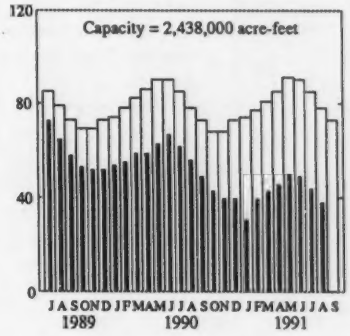


CALIFORNIA RESERVOIR INDEX STATIONS



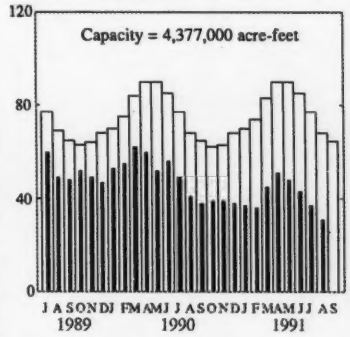


1. Clair Engle Lake near Lewiston

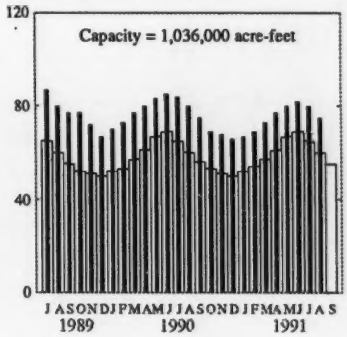


PERCENT OF NORMAL CAPACITY

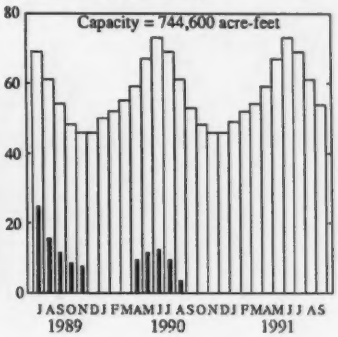
2. Shasta Lake near Redding



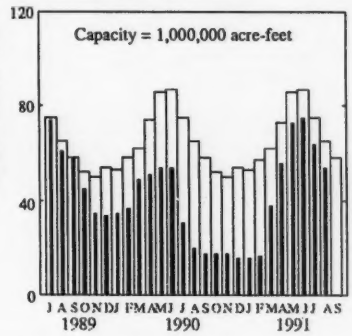
3. Lake Almanor near Prattville



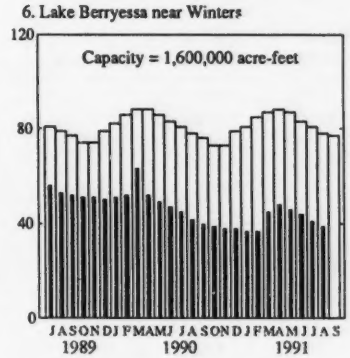
4. Lake Tahoe at Tahoe City



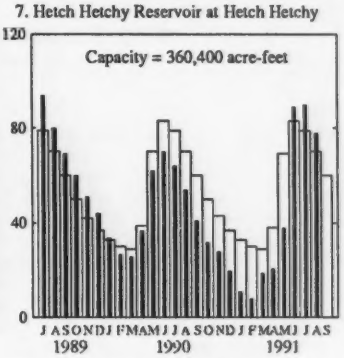
5. Folsom Lake near Folsom



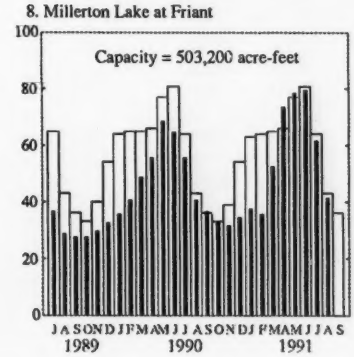
6. Lake Berryessa near Winters



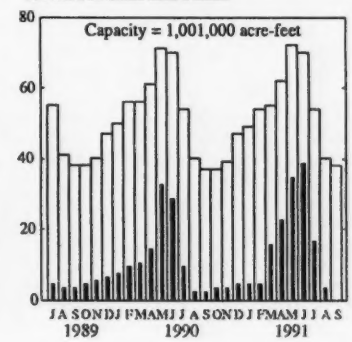
7. Hetch Hetchy Reservoir at Hetch Hetchy



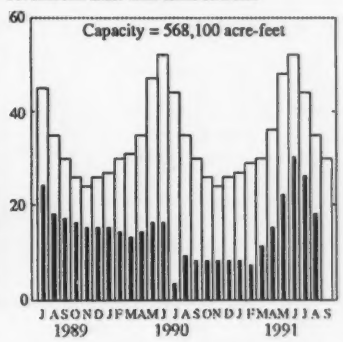
8. Millerton Lake at Friant



9. Pine Flat Lake near Piedra

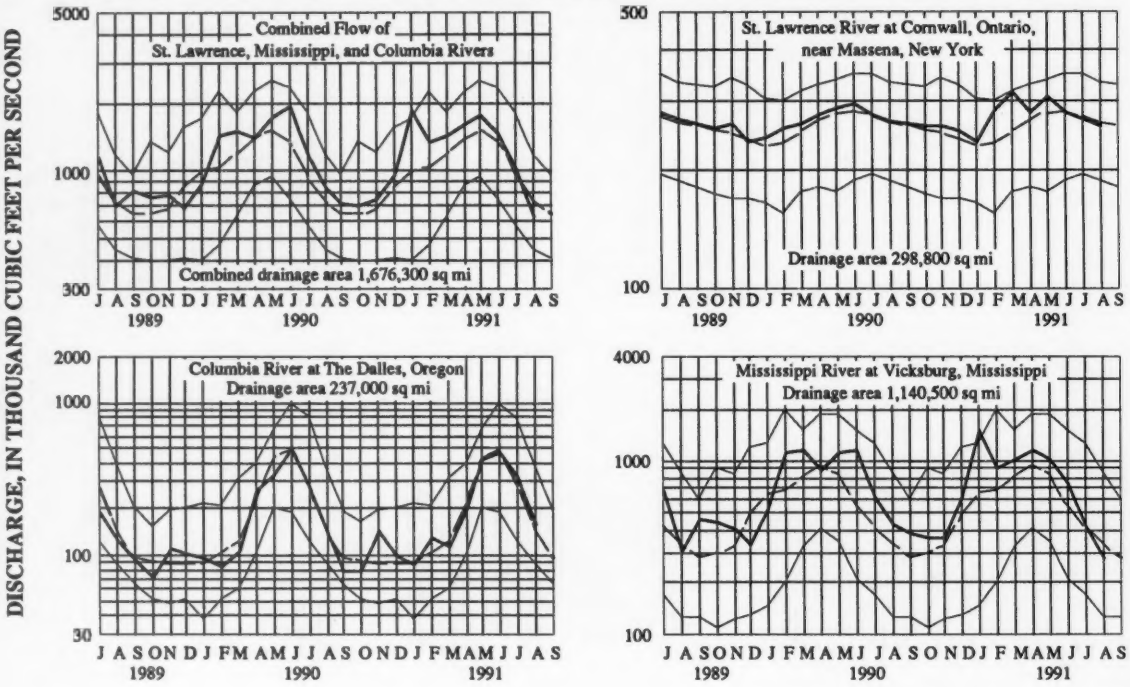


10. Isabella Lake near Lake Isabella



HYDROGRAPHS FOR THE "BIG THREE" RIVERS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period.


DISCHARGE, IN THOUSAND CUBIC FEET PER SECOND
Combined Flow of St. Lawrence, Mississippi, and Columbia Rivers
Combined drainage area 1,676,300 sq mi
5000
1000
300
St. Lawrence River at Cornwall, Ontario, near Massena, New York
Drainage area 298,800 sq mi
500
100
Columbia River at The Dalles, Oregon
Drainage area 237,000 sq mi
2000
1000
100
30
Mississippi River at Vicksburg, Mississippi
Drainage area 1,140,500 sq mi
4000
1000
100
J A S O N D J F M A M J J A S O N D J F M A M J J A S
1989
1990
1991

Provisional data; subject to revision

DISSOLVED SOLIDS AND WATER TEMPERATURES, FOR AUGUST 1991, AT DOWNSTREAM SITES ON FIVE LARGE RIVERS

Station number	Station name	August data of following calendar years	Stream discharge during month	Dissolved-solids concentration[1]		Dissolved-solids discharge[1]			Water temperature[2]		
			Mean (cfs)	Minimum (mg/L)	Maximum (mg/L)	Mean	Minimum (tons per day)	Maximum	Mean in °C	Minimum in °C	Maximum in °C
01463500	Delaware River at Trenton, New Jersey, (Morrisville, Pennsylvania)	1991	3,167	108	141	1,063	837	1,577	26.5	24.5	29.0
		1945-90 (Extreme yr)	6,046 (1945)	67 (1945)	158 (1967)	[3]1,772	505 (1965)	21,500 (1955)	[3]25.0	17.5	30.5
			[4]4,547								
07289000	Mississippi River at Vicksburg, Mississippi	1991	278,900	267	291	208,900	193,600	230,600	29.0	28.0	30.5
		1976-90 (Extreme yr)	362,100 (1980)	200 (1980)	345 (1986)	237,400	114,000 (1988)	442,000 (1979)	25.5	26.0	34.0
			[4]337,900								
03612500	Ohio River at lock and dam 53, near Grand Chain, Illinois, (streamflow station at Metropolis, Illinois)	1991	85,000	171	241	.....	37,900	54,500	...	27.0	28.0
		1955-90 (Extreme yr)	129,400 (1983)	121 (1983)	339 (1977)	.....	4,490 (1981)	246,000 (1958)	...	17.0	30.5
			[4]121,500								
06934500	Missouri River at Hermann, Missouri. (60 miles west of St. Louis, Missouri)	1991	40,550	452	464	48,400	47,300	52,600	27.0	26.0	29.0
		1976-90 (Extreme yr)	69,310 (1981)	218 (1981)	535 (1979)	75,770	43,000 (1977)	180,000 (1982)	27.0	22.0	31.0
			[4]55,910								
14128910	Columbia River at Warrendale, Oregon (streamflow station at The Dalles, Oregon)	1991	.....	.....	.....	.....	.....	.....	...	...	...
		1976-90 (Extreme yr)	123,600 (1976)	71 (1976)	100 (1977)	28,200	14,200 (1978)	52,500 (1976)	19.0	18.5	22.0
			[4]143,600								

[1]Dissolved-solids concentrations, when not analyzed directly, are calculated on basis of measurements of specific conductance.
[2]To convert °C to °F: [(1.8 x °C) + 32] = °F.
[3]Mean for 7-year period (1983-90).
[4]Median of monthly values for 30-year reference period, water years 1951-80, for comparison with data for current month.

Provisional data; subject to revision

FLOW OF LARGE RIVERS DURING AUGUST 1991

Station number	Stream and place of determination	Drainage area (square miles)	Average discharge through September 1985 (cubic feet per second)	August 1991					
				Monthly mean discharge (cubic feet per second)	Percent of median monthly discharge 1951–80	Change in discharge from previous month (percent)	Discharge near end of month		
							Cubic feet per second	Million gallons per day	Date
01014000	St. John River below Fish River at Fort Kent, Maine	5,665	9,758	† 2,253	54	8	3,820	2,470	31
01318500	Hudson River at Hadley, New York	1,664	2,908	† 500	48	–25	320	206	31
01357500	Mohawk River at Cohoes, New York	3,456	5,683	† 1,060	69	13	500	320	31
01463500	Delaware River at Trenton, New Jersey	6,780	11,670	3,167	70	–8	2,980	1,930	31
01570500	Susquehanna River at Harrisburg, Pennsylvania	24,100	34,340	4,640	54	–3	4,940	3,190	28
01646500	Potomac River near Washington, District of Columbia	11,560	[1]11,500	[1]2,580	74	–7	.....	.....	...
02105500	Cape Fear River at William O. Huske Lock, near Tarheel, North Carolina.	4,852	5,002	2,742	109	24	.....	.....	...
02131000	Pee Dee River at Peedee, South Carolina	8,830	9,871	* 12,110	225	97	5,140	3,320	31
02226000	Altamaha River at Doctortown, Georgia	13,600	13,730	* 18,460	311	29	24,500	15,800	31
02320500	Suwannee River at Branford, Florida	7,880	6,986	* 20,670	379	43	18,100	11,700	31
02358000	Apalachicola River at Chattahoochee, Florida	17,200	22,420	* 22,380	167	–17	18,300	11,800	31
02467000	Tombigbee River at Demopolis lock and dam, near Coatopa, Alabama.	15,385	23,520	5,128	108	–31	8,600	5,560	31
02489500	Pearl River near Bogalusa, Louisiana	6,573	9,880	* 4,043	150	–46	4,530	2,930	31
03049500	Allegheny River at Natrona, Pennsylvania	11,410	[1]19,580	† [1]2,620	47	–31	2,280	1,470	27
03085000	Monongahela River at Braddock, Pennsylvania	7,337	[1]12,480	† [1]2,220	52	2	1,910	1,230	27
03193000	Kanawha River at Kanawha Falls, West Virginia	8,367	12,550	† 3,253	72	–11	2,240	1,450	29
03234500	Scioto River at Higby, Ohio	5,131	4,583	† 734	60	–25	613	396	31
03294500	Ohio River at Louisville, Kentucky[2#]	91,170	115,800	26,300	72	–41	17,400	11,200	28
03377500	Wabash River at Mount Carmel, Illinois	28,635	27,660	† 4,941	54	–35	4,120	2,660	31
03469000	French Broad River below Douglas Dam, Tennessee[3#]	4,543	[1]6,739	* [1]6,377	198	31	.....	.....	...
04084500	Fox River at Rapide Croche Dam, near Wrightstown, Wisconsin.[2]	6,010	4,238	2,299	107	6	1,680	1,090	31
04264331	St. Lawrence River at Cornwall, Ontario, near Massena, New York.[4#]	298,800	243,900	260,000	99	–3	260,000	168,000	31
02NG001	St. Maurice River at Grand Mere, Quebec	16,300	24,910	11,000	66	113	19,000	12,300	30
05082500	Red River of the North at Grand Forks, North Dakota	30,100	2,593	1,035	90	–66	613	396	31
05133500	Rainy River at Manitou Rapids, Minnesota	19,400	12,920	† 5,960	59	–63	4,850	3,130	26
05330000	Minnesota River near Jordan, Minnesota	16,200	3,680	* 9,519	732	–33	5,230	3,380	31
05331000	Mississippi River at St. Paul, Minnesota[#]	36,800	[1]11,020	* 16,980	232	–38	11,300	7,300	31
05365500	Chippewa River at Chippewa Falls, Wisconsin	5,650	5,149	3,357	116	–28	1,800	1,160	31
05407000	Wisconsin River at Muscoda, Wisconsin	10,400	8,710	5,430	103	–8	4,260	2,750	31
05446500	Rock River near Joslin, Illinois	9,549	6,080	2,710	85	–19	2,020	1,300	31
05474500	Mississippi River at Keokuk, Iowa[#]	119,000	63,790	50,770	127	–38	37,900	24,500	31
06214500	Yellowstone River at Billings, Montana	11,795	7,056	† 3,550	65	–67	2,990	1,930	29
06934500	Missouri River at Hermann, Missouri[#]	524,200	80,880	† 40,550	73	–36	38,900	25,100	31
07289000	Mississippi River at Vicksburg, Mississippi[5#]	1,140,500	584,000	278,900	83	–35	279,000	180,000	26
07331000	Washita River near Dickson, Oklahoma	7,202	1,402	* 516	158	–2	600	390	30
08276500	Rio Grande below Taos Junction Bridge, near Taos, New Mexico.	9,730	742	591	205	–11	450	290	31
09315000	Green River at Green River, Utah	44,850	6,391	2,578	81	–13	.....	.....	...
11425500	Sacramento River at Verona, California	21,251	19,430	† 7,944	74	4	.....	.....	...
13269000	Snake River at Weiser, Idaho	69,200	18,520	† 8,090	73	–2	8,820	5,700	31
13317000	Salmon River at White Bird, Idaho	13,550	11,390	† 4,090	71	–61	3,490	2,260	31
13342500	Clearwater River at Spalding, Idaho	9,570	15,510	3,440	91	–72	2,920	1,890	31
14105700	Columbia River at The Dalles, Oregon[6#]	237,000	[1]193,500	* [1]160,200	112	–51	120,000	77,800	31
14191000	Willamette River at Salem, Oregon	7,280	[1]23,690	† [1]2,968	74	–45	7,090	4,580	31
15515500	Tanana River at Nenana, Alaska	25,600	23,810	50,910	92	–11	39,700	25,700	31
08MF005	Fraser River at Hope, British Columbia	83,800	96,250	* 152,500	121	–31	.....	.....	...

#Indicates stations excluded from the combination bar/line graph. See Explanation of Data.

* Above-normal range

† Below-normal range

[1]Adjusted.

[2]Records furnished by Corps of Engineers.

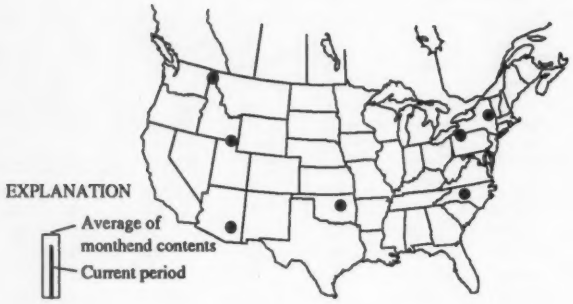
[3]Records furnished by Tennessee Valley Authority.

[4]Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y., when adjusted for storage in Lake St. Lawrence.

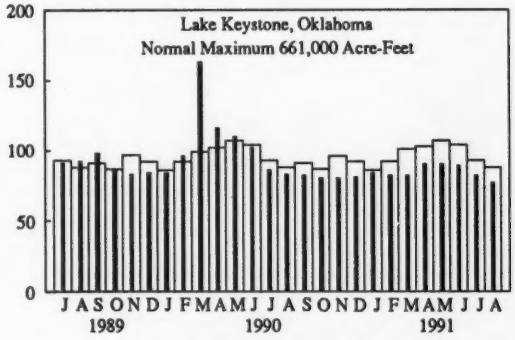
[5]Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.

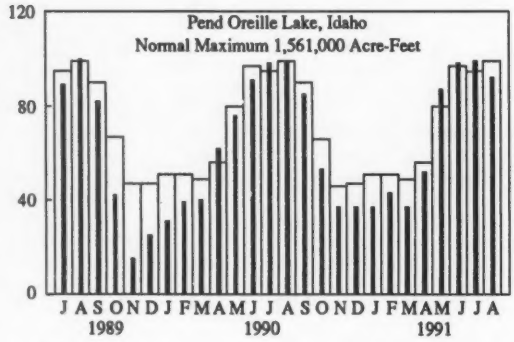
[6]Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

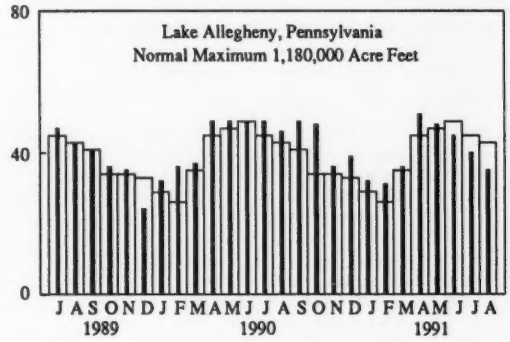
USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS

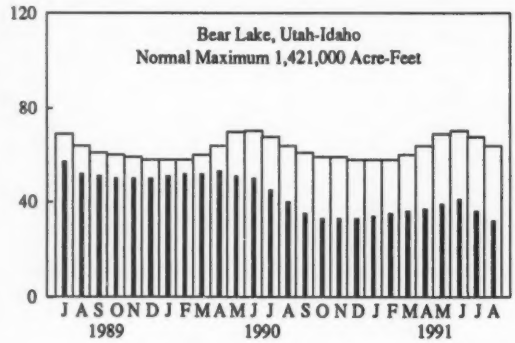


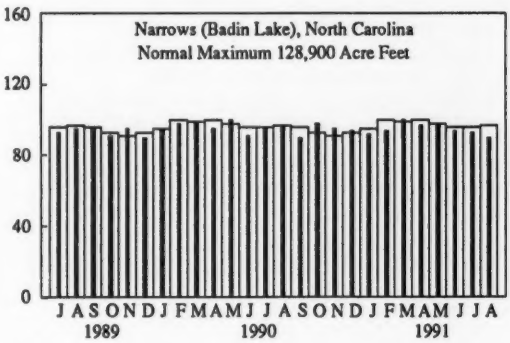
PERCENT OF NORMAL MAXIMUM

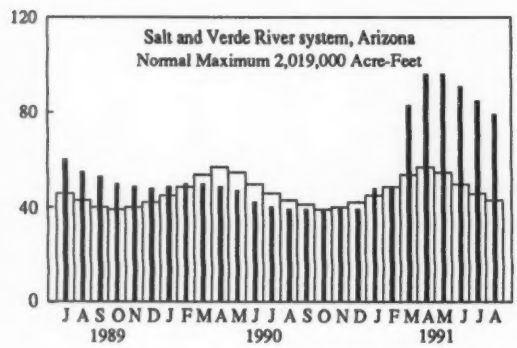


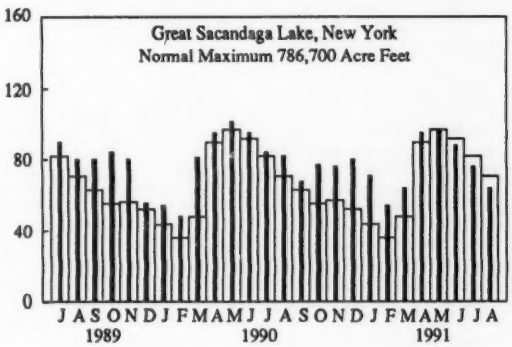







Narrows (Badin Lake), North Carolina
Normal Maximum 128,900 Acre Feet
160
120
80
40
0
J A S O N D J F M A M J J A S O N D J F M A M J J A
1989
1990
1991


Salt and Verde River system, Arizona
Normal Maximum 2,019,000 Acre-Feet
120
80
40
0
J A S O N D J F M A M J J A S O N D J F M A M J J A
1989
1990
1991


Great Sacandaga Lake, New York
Normal Maximum 786,700 Acre Feet
160
120
80
40
0
J A S O N D J F M A M J J A S O N D J F M A M J J A
1989
1990
1991

Provisional data; subject to revision

USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS NEAR END OF AUGUST 1991

[Contents are expressed in percent of reservoir or reservoir system capacity. The usable capacity of reservoir or reservoir system is shown in the column headed "Normal maximum"]

Reservoir or reservoir system Principal uses: F-Flood control I-Irrigation M-Municipal P-Power R-Recreation W-Industrial	Percent of normal maximum: End of August 1991	End of August 1990	Average for end of August	End of July 1991	Normal maximum (acre-feet)[1]
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	...	60	49	46	[2]226,300
QUEBEC					
Allard (P)	68	81	69	71	280,600
Gouin (P)	69	69	69	72	6,954,000
MAINE					
Seven Reservoir Systems (MP)	*74	79	68	74	4,107,000
NEW HAMPSHIRE					
First Connecticut Lake (P)	84	85	83	74	76,450
Lake Francis (FPR)	78	95	81	79	99,310
Lake Winnipesaukee (PR)	79	93	75	71	165,700
VERMONT					
Harriman (P)	75	72	70	70	116,200
Somerset (P)	†68	85	75	70	57,390
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	82	87	77	81	77,920
NEW YORK					
Great Sacandaga Lake (FPR)	†64	82	71	76	786,700
Indian Lake (FMP)	*80	91	74	90	103,300
New York City Reservoir System (MW)	†64	86	82	74	1,680,000
NEW JERSEY					
Wanaque (M)	†43	84	75	61	85,100
PENNSYLVANIA					
Allegheny (FPR)	†35	46	43	40	1,180,000
Pymatuning (FMR)	†81	95	88	86	188,000
Raystown Lake (FR)	65	67	63	66	761,900
Lake Wallenpaupack (PR)	68	69	64	72	157,800
MARYLAND					
Baltimore Municipal System (M)	†81	95	87	86	261,900
NORTH CAROLINA					
Bridgewater (Lake James) (P)	*95	97	88	96	288,800
Narrows (Badin Lake) (P)	†90	96	97	93	128,900
High Rock Lake (P)	77	91	74	89	234,800
SOUTH CAROLINA					
Lake Murray (P)	*88	80	74	89	1,614,000
Lakes Marion and Moultrie (P)	*84	80	70	91	1,777,000
SOUTH CAROLINA-GEORGIA					
Strom Thurmond Lake (FP)	*77	60	65	85	1,730,000
GEORGIA					
Burton (PR)	*100	97	88	99	104,000
Sinclair (MPR)	87	89	86	88	214,000
Lake Sidney Lanier (FMPR)	*67	51	56	66	1,686,000
ALABAMA					
Lake Martin (P)	*96	92	86	98	1,375,000
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	*59	57	46	68	2,293,000
Douglas Lake (FPR)	*71	45	46	80	1,395,000
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	*87	71	68	88	1,012,000
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	*65	61	54	77	2,880,000
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	*84	50	66	89	1,478,000
WISCONSIN					
Chippewa and Flambeau (FR)	78	84	76	94	365,000
Wisconsin River (21 Reservoirs) (PR)	*82	75	64	90	399,000
MINNESOTA					
Mississippi River Headwater System (FMR)	39	37	34	43	1,640,000
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	88	60	90	68	22,700,000
SOUTH DAKOTA					
Angostura (I)	75	42	71	85	130,770
Belle Fourche (I)	†15	16	37	34	185,200
Lake Francis Case (FIP)	77	79	81	78	4,589,000
Lake Oahe (FIP)	†62	59	68	65	22,240,000
Lake Sharpe (FIP)	101	99	101	102	1,697,000
Lewis and Clark Lake (FIP)	†94	96	104	80	432,000
NEBRASKA					
Lake McConaughy (IP)	†43	47	68	52	1,948,000
OKLAHOMA					
Bufaula (FPR)	86	95	84	91	2,378,000
Keystone (FPR)	†77	83	88	82	661,000
Tenkiller Ferry (FPR)	*98	102	92	101	628,200
Lake Altus (FIMR)	50	64	48	68	133,000
Lake O'The Cherokees (FPR)	89	91	84	91	1,492,000
OKLAHOMA-TEXAS					
Lake Texoma (FMPRW)	96	94	91	97	2,722,000
TEXAS					
Bridgeport (IMW)	*89	95	51	90	386,400
Canyon (FMR)	*86	96	80	88	385,600
International Amistad (FIMPW)	*93	79	80	86	3,497,000
International Falcon (FIMPW)	†33	41	63	55	2,668,000
Livingston (IMW)	*100	99	88	98	1,788,000
Possum Kingdom (IMPRW)	93	94	95	90	570,200
Red Bluff (P)	†16	18	24	17	307,000
Toledo Bend (P)	*91	84	85	95	4,472,000
Twin Buttes (FIM)	33	38	31	37	177,800
Lake Kemp (IMW)	*92	98	83	94	268,000
Lake Meredith (FMW)	38	34	38	37	796,900
Lake Travis (FIMPRW)	*85	85	76	91	1,144,000
MONTANA					
Canyon Ferry (FIMPR)	80	82	85	89	2,043,000
Fort Peck (FPR)	†65	60	87	65	18,910,000
Hungry Horse (FIPR)	97	99	93	99	3,451,000
WASHINGTON					
Ross (PR)	99	99	95	100	1,052,000
Franklin D. Roosevelt Lake (IP)	†96	97	102	101	5,022,000
Lake Chelan (PR)	97	97	98	98	676,100
Lake Cushman (PR)	*103	36	95	102	359,500
Lake Merwin (P)	102	107	102	105	245,600
IDAHO					
Boise River (4 Reservoirs) (FIP)	†22	38	55	37	1,235,000
Coeur d'Alene Lake (P)	*98	94	76	97	238,500
Pend Oreille Lake (FP)	†92	99	99	99	1,561,000
IDAHO-WYOMING					
Upper Snake River (8 Reservoirs) (MP)	49	34	54	89	4,401,000
WYOMING					
Boysen (FIP)	*92	74	86	96	802,000
Buffalo Bill (IP)	†80	54	87	98	421,300
Keyhole (F)	†17	17	43	21	193,800
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	†38	33	51	47	3,056,000
COLORADO					
John Martin (FIR)	†2	8	19	3	364,400
Taylor Park (IR)	84	84	79	94	106,200
Colorado-Big Thompson Project (I)	60	51	63	63	730,300
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Fontenelle, Navajo, and Blue Mesa Reservoirs (IPPR)	†66	69	79	68	31,620,000
UTAH-IDAHO					
Bear Lake (IPR)	†32	40	64	36	1,421,000
CALIFORNIA					
Folsom (FIP)	†53	19	64	63	1,000,000
Hetch Hetchy (MP)	*77	53	70	89	360,400
Isabella (FIR)	†18	9	34	26	568,100
Pine Flat (FI)	†3	2	39	16	1,001,000
Clair Engle Lake (Lewiston) (P)	†37	55	78	43	2,438,000
Lake Almanor (P)	*74	79	60	79	1,036,000
Lake Berryessa (FIMW)	†38	41	77	40	1,600,000
Millerton Lake (FI)	41	40	43	61	503,200
Shasta Lake (FIPR)	†30	40	68	36	4,377,000
CALIFORNIA-NEVADA					
Lake Tahoe (IPR)	†0	3	60	0	744,600
NEVADA					
Rye Patch (I)	†4	3	57	7	194,300
ARIZONA-NEVADA					
Lake Mead and Lake Mohave (FIMP)	74	77	75	74	27,970,000
ARIZONA					
San Carlos (IF)	*35	4	20	40	935,100
Salt and Verde River System (IMPR)	*79	39	43	85	2,019,100
NEW MEXICO					
Conchas (FIR)	†72	62	87	56	315,700
Elephant Butte and Caballo (FIPR)	*67	59	38	70	2,394,000

[1] 1 acre-foot = 0.04356 million cubic feet = 0.326 million gallons = 0.504 cubic feet per second per day.

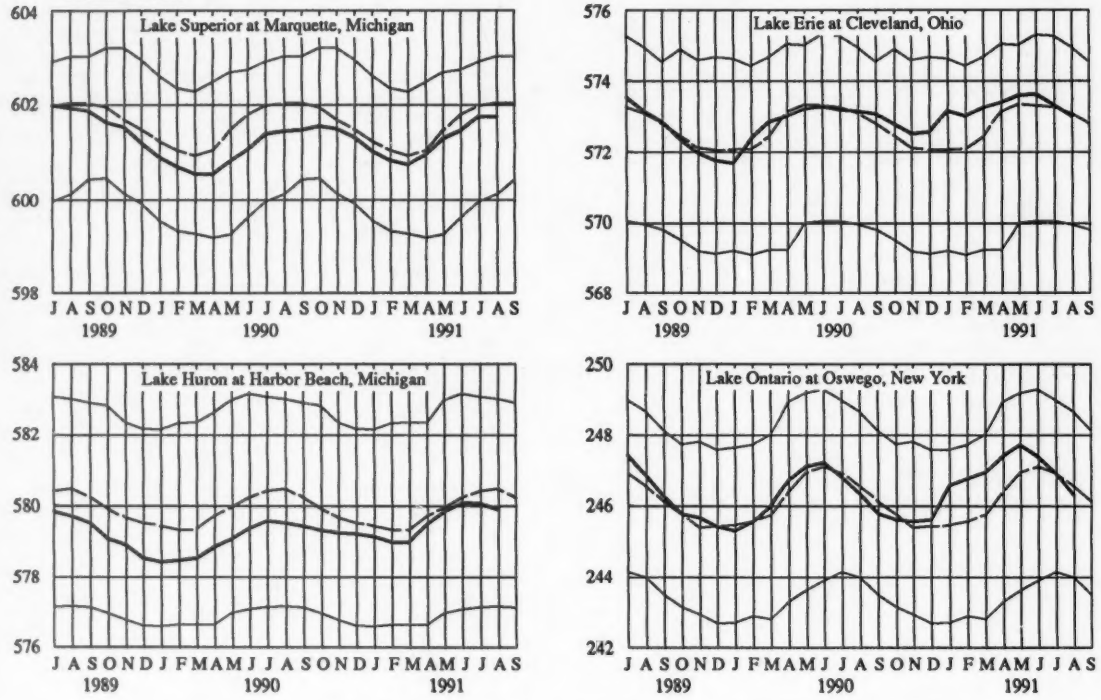
[2] Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

* Above-average range

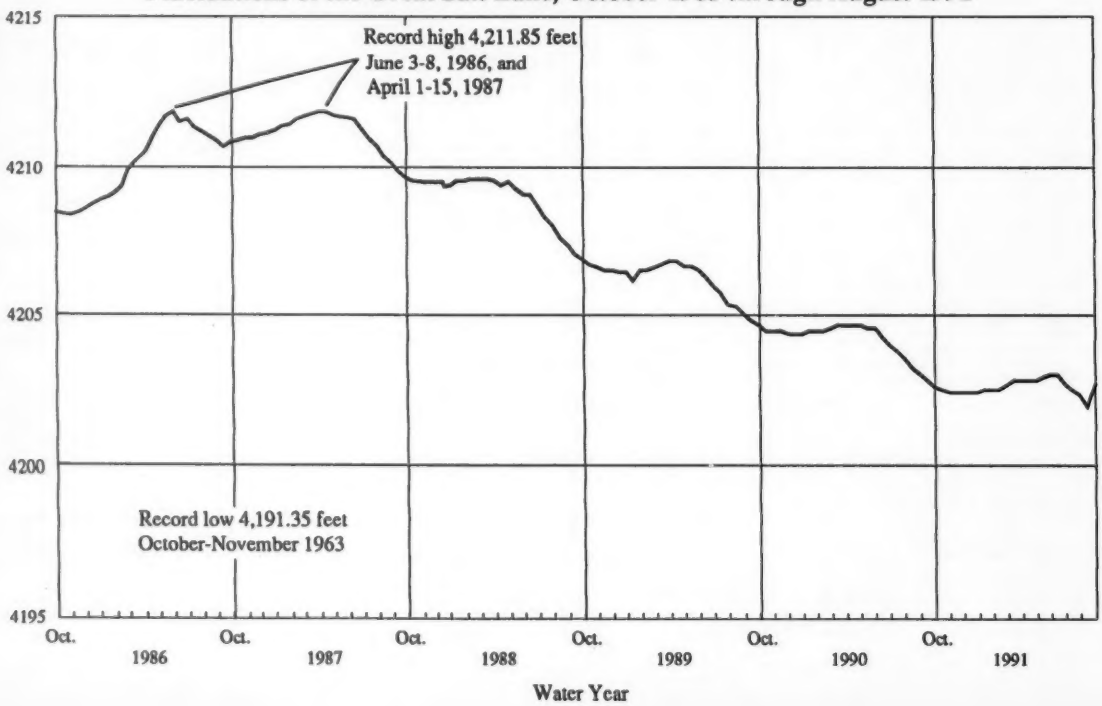
† Below-average range

GREAT LAKES ELEVATIONS

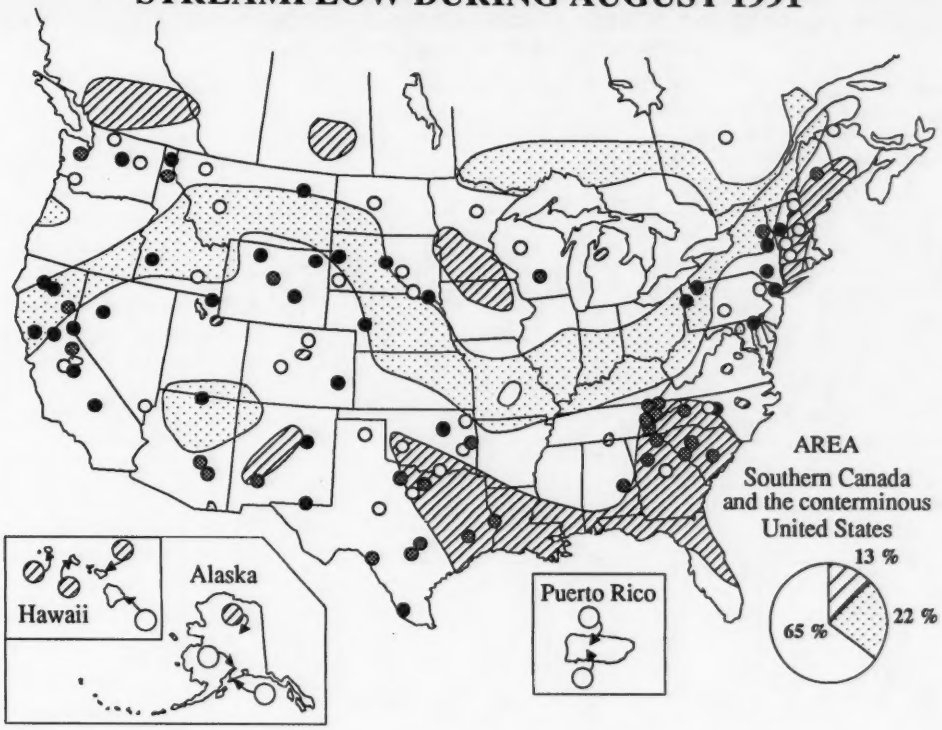
Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period. Data from National Ocean Service.



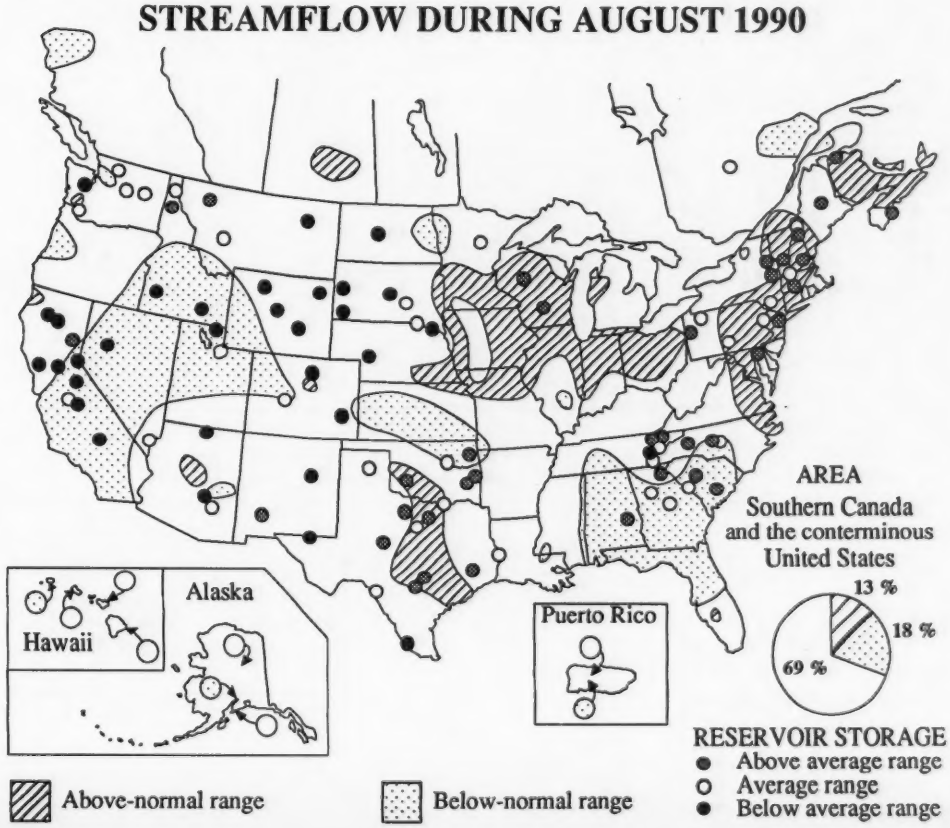
Fluctuations of the Great Salt Lake, October 1985 through August 1991



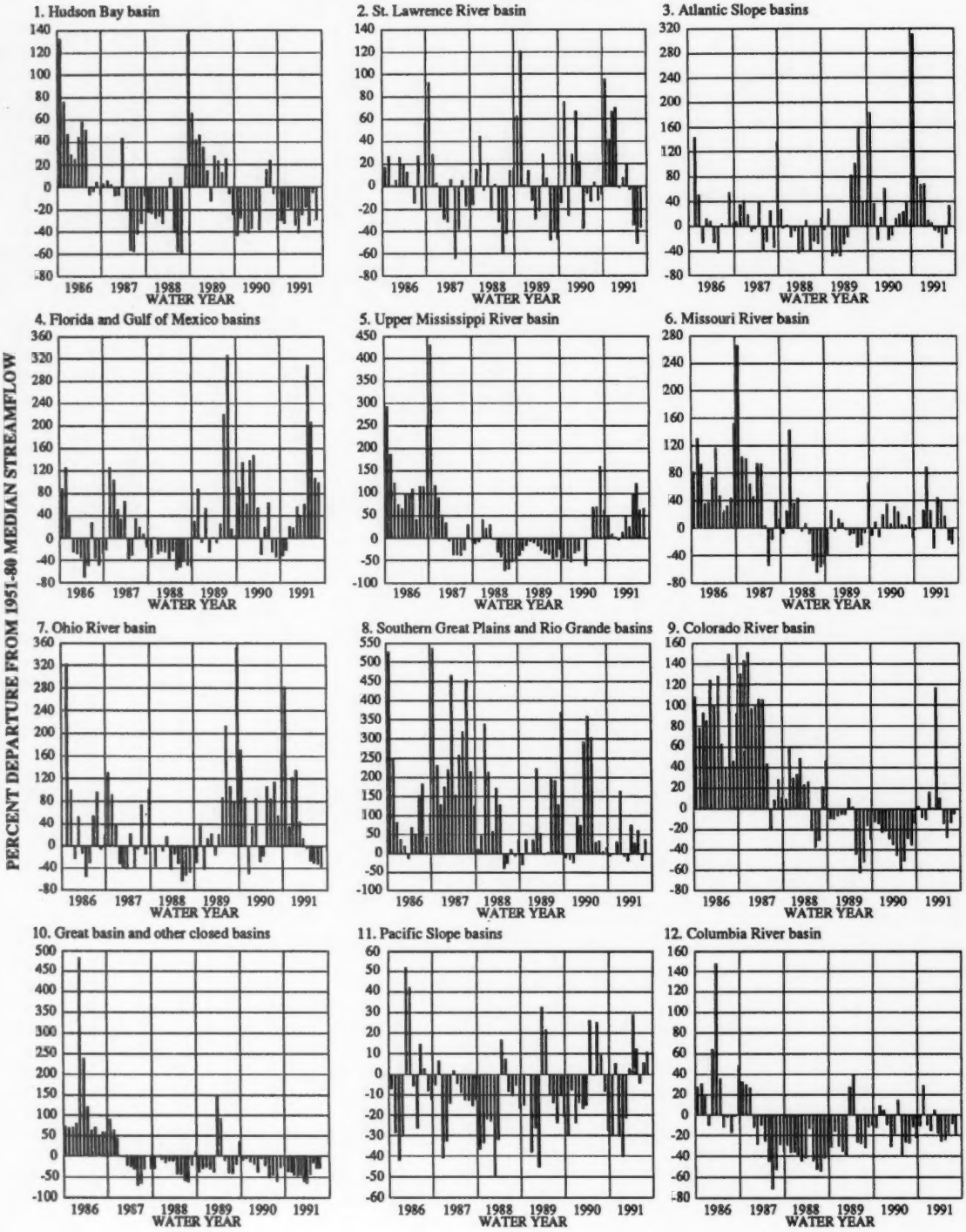
STREAMFLOW DURING AUGUST 1991



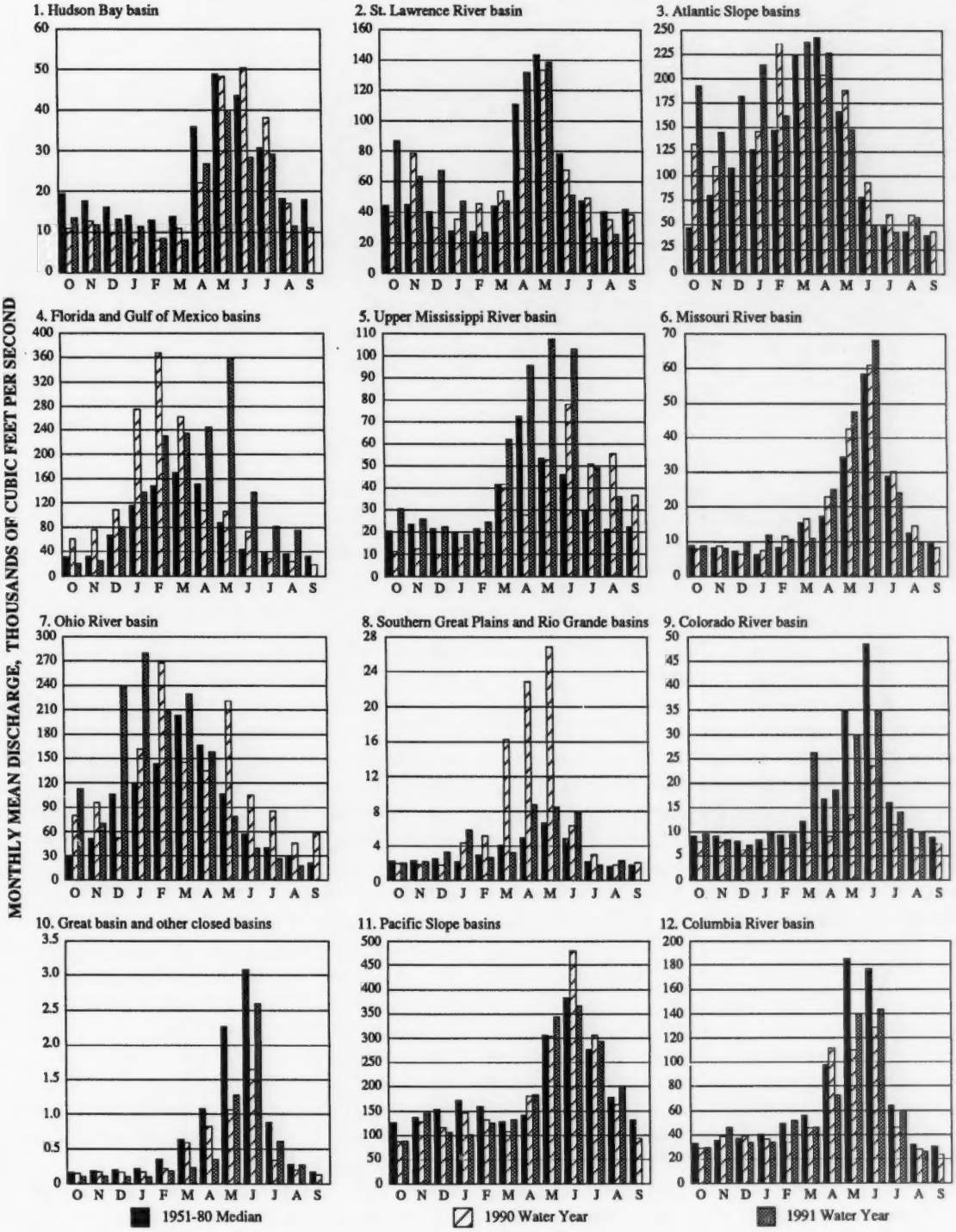
STREAMFLOW DURING AUGUST 1990



MONTHLY DEPARTURE OF ACTUAL STREAMFLOW (OCTOBER 1985-AUGUST 1991) FROM MEDIAN STREAMFLOW (1951-80)


1. Hudson Bay basin
2. St. Lawrence River basin
3. Atlantic Slope basins
4. Florida and Gulf of Mexico basins
5. Upper Mississippi River basin
6. Missouri River basin
7. Ohio River basin
8. Southern Great Plains and Rio Grande basins
9. Colorado River basin
10. Great basin and other closed basins
11. Pacific Slope basins
12. Columbia River basin
PERCENT DEPARTURE FROM 1951-80 MEDIAN STREAMFLOW
1986 1987 1988 1989 1990 1991
WATER YEAR

ACTUAL MONTHLY STREAMFLOW, 1990 AND 1991 WATER YEARS, COMPARED WITH MEDIAN MONTHLY STREAMFLOW, 1951-80


1. Hudson Bay basin
2. St. Lawrence River basin
3. Atlantic Slope basins
4. Florida and Gulf of Mexico basins
5. Upper Mississippi River basin
6. Missouri River basin
7. Ohio River basin
8. Southern Great Plains and Rio Grande basins
9. Colorado River basin
10. Great basin and other closed basins
11. Pacific Slope basins
12. Columbia River basin
O N D J F M A M J J A S
MONTHLY MEAN DISCHARGE, THOUSANDS OF CUBIC FEET PER SECOND
1951-80 Median
1990 Water Year
1991 Water Year

GROUND-WATER CONDITIONS DURING AUGUST 1991

Ground-Water Regions
1. Western Mountain Ranges
2. Alluvial Basins
3. Columbia Lava Plateau
4. Colorado Plateau and Wyoming Basin
5. High Plains
6. Nonglaciated Central Region
7. Glaciated Central Region
8. Piedmont and Blue Ridge
9. Northeast and Superior Uplands
10. Atlantic and Gulf Coastal Plain
11. Southeast Coastal Plain
Water Levels and Changes In Water Levels
Monthly high (▲ indicates all-time high)
Higher than last month
About the same as last month
Lower than last month
Above average
About average
Below average
Monthly low (▼ indicates all-time low)
(The absence of all arms on the well symbol indicates that no data are available this month. The absence of arms on the left side of the symbol indicates that no data were available last month. The absence of arms on the right side of the symbol indicates that no long-term average is available for the month.)
Well Location/Aquifer Type/Pumpage Near Well
Water-table (unconfined) aquifer
Artesian (confined) aquifer
Little or no withdrawal from aquifer
Moderate withdrawal from aquifer
Heavy withdrawal from aquifer

New extremes occurred at 26 ground-water index stations (see table on page 18) during August —21 lows (including 6 all-time) and 5 highs—compared with 28 new extremes last month. Graphs showing water levels at seven stations for the past 26 months, including one of those at which an August low occurred (in the High Plains region in Kansas) and one at which the previous August low was equalled (in the Columbia Lava Plateau region in Idaho), are on page 19. The other graphs on page 19 are for wells in the Nonglaciated Central region in Texas, the Glaciated Central region in Michigan, the Southeast Coastal Plain region in Florida, the Atlantic and Gulf Coastal Plain region in North Carolina and the Northeast and Superior Uplands region in New Hampshire.

Ground-water levels in the Western Mountain Ranges region were mixed with respect to last month's levels and with respect to long-term average. Level fell to an August low in the well in Montana.

In the Alluvial Basins region, levels were below last month's levels in Washington and Texas and mixed with respect to last month's levels elsewhere. Levels were above long-term average in Washington, below long-term average in Utah and Texas, and mixed with respect to average elsewhere. August lows occurred in wells in Nevada, Utah, New Mexico, and Texas. An August high occurred in one well in New Mexico.

In the Columbia Lava Plateau region, ground-water levels were at or above last month's levels in Idaho and below last month's level in Oregon. Levels were below long-term average throughout the Region. August lows occurred in wells in Idaho and Oregon. Water in one well in Idaho tied a previous August low level. Level fell to an all-time low in a well in the Columbia River basalt aquifer at Pendleton, Oregon.

Ground-water levels in the Colorado Plateau and Wyoming Basin region were above last month's levels in New Mexico and below last month's level in Utah. Levels were mixed with respect to long-term average. An August low occurred in one well in New Mexico.

In the High Plains region, ground-water levels were mixed with respect to last month's levels and below long-term average throughout the region. Levels fell to all-time lows in wells in the Ogallala aquifer near Colby, Kansas and near Lubbock, Texas.

Water levels in the Nonglaciated Central region were above last month's levels in South Dakota, Colorado, and West Virginia, mixed in Kansas and generally below last month's levels elsewhere. Levels were generally below

Provisional data; subject to revision

WATER LEVELS IN KEY OBSERVATION WELLS IN SOME REPRESENTATIVE AQUIFERS IN THE CONTERMINOUS UNITED STATES–AUGUST 1991

GROUND–WATER REGION Aquifer and Location	Aquifer type and local aquifer pumpage	Depth of well in feet	Water level in feet below land–surface datum	Departure from average in feet	Net change in water level in feet since: Last month	Net change in water level in feet since: Last year	Year records began	Remarks
WESTERN MOUNTAIN RANGES (1)								
Rathdrum Prairie aquifer near Athol, northern Idaho	●	485	457.3	1.5	0.3	3.5	1929	
ALLUVIAL BASINS (2)								
Alluvial valley fill aquifer in Steptoe Valley, Nevada	□	122	9.38	3.33	–.46	–.27	1949	
Alluvial sand and gravel aquifer, Baldwin Park, California	●	200	...	...	...	...	1932	
Valley fill aquifer, Elfrida area near Douglas, Arizona	◉	124	103.32	–19.46	–1.25	–2.06	1947	
Hueco bolson aquifer at El Paso, Texas	●	640	273.00	–19.46	–.17	–1.12	1964	Aug. low
COLUMBIA LAVA PLATEAU (3)								
Snake River Plain aquifer near Eden, Idaho	●	208	123.6	–7.1	1.3	–5.1	1962	
Columbia River basalt aquifer, Pendleton, Oregon		1,501	222.93	–39.80	–.48	–.36	1965	All–time low
COLORADO PLATEAU AND WYOMING BASIN (4)								
Dakota aquifer near Blanding, Utah	□	140	48.79	–3.47	–.05	–2.96	1960	
HIGH PLAINS (5)								
Ogallala aquifer near Colby, Kansas	●	175	131.07	–10.69	–.32	–.89	1947	All–time low
Southern High Plains aquifer, Lovington, New Mexico	◉	212	60.11	–5.46	.23	–.05	1971	
NONGLACIATED CENTRAL REGION (6)								
Sentinel Butte aquifer near Dickinson, North Dakota	○	160	21.51	–3.49	–.32	–.89	1968	All–time low
Sand and gravel Pleistocene aquifer near Valley Center, Kansas	●	54	21.14	–4.02	–.57	–1.64	1937	Aug. low
Glacial outwash sand and gravel aquifer near Louisville, Kentucky	◉	94	16.96	7.26	–.17	.59	1945	
Upper Pennsylvanian aquifer in the Central Appalachians Plateau near Glenville, West Virginia	○	25	13.36	3.55	.61	–.66	1953	
GLACIATED CENTRAL REGION (7)								
Fluvial sand and gravel aquifer, Platte River Valley, near Ashland, Nebraska	●	12	6.90	–0.97	–1.47	...	1933	
Sheyenne Delta aquifer near Wyndmere, North Dakota	○	40	8.14	–2.01	–.64	.43	1963	
Pleistocene (glacial drift) aquifer at Princeton in northern Illinois	◉	29	8.58	3.52	–0.18	–3.33	1942	
Shallow drift aquifer near Roscommon in north–central part of Lower Peninsula, Michigan	○	14	4.60	.38	–.29	.60	1934	
Silurian–Devonian carbonate aquifer near Dola, Ohio	□	51	9.61	–1.50	–1.61	–3.47	1954	
PIEDMONT AND BLUE RIDGE (8)								
Water–table aquifer in Petersburg Granite, southeastern Piedmont, Colonial Heights, Virginia	○	100	16.85	–1.04	–.09	–2.91	1939	
Weathered granite aquifer, western Piedmont, Mocksville area, North Carolina	○	31	15.79	4.39	–.25	1.15	1981	Aug. high
Surficial aquifer at Griffin, Georgia	○	30	15.22	1.09	–.67	3.56	1943	
NORTHEAST AND SUPERIOR UPLANDS (9)								
Pleistocene glacial outwash aquifer, at Camp Ripley, near Little Falls, Minnesota	◉	59	14.02	.5	–.36	.62	1949	
Glacial till aquifer at Augusta, Maine	○	22	7.61	1.09	1.40	–1.07	1960	
Shallow sand aquifer (glacial deposits), Acton, Massachusetts	●	34	19.87	–.45	–.17	–.38	1965	
Pleistocene sand aquifer near Morrisville, Vermont	○	50	20.30	–.63	–.14	–1.22	1966	
ATLANTIC AND GULF COASTAL PLAIN (10)								
Columbia deposits aquifer near Camden, Delaware	○	11	7.40	–.64	.47	–.80	1950	
Memphis sand aquifer near Memphis, Tennessee	■	384	107.66	–16.11	–.68	.40	1940	
Eutaw aquifer in the City of Montgomery, Alabama	■	270	25.4	–1.1	–.5	1.3	1952	
Evangeline aquifer at Houston, Texas	■	1,152	300.74	2.77	.35	7.78	1978	
SOUTHEAST COASTAL PLAIN (11)								
Upper Floridan aquifer on Cockspur Island, Savannah area, Georgia	■	348	34.26	–5.10	1.10	5.63	1956	
Upper Floridan aquifer, Jacksonville, Florida	■	905	–23.0	–3.6	.6	4.2	1930	
Biscayne aquifer near Homestead, Florida	○	20	6.39	–.20	.16	–.36	1932	

long-term average in the Dakotas, Kansas, Pennsylvania, Maryland, and Virginia; above average in Missouri, Kentucky, West Virginia, and Georgia; and mixed with respect to average in Texas. August lows occurred in two wells in Kansas. A monthly high occurred in one well in Texas. Level fell to an all-time low in a well in the Sentinel Butte aquifer near Dickinson, North Dakota.

Ground-water levels in the Glaciated Central region were mixed with respect to last month's in Iowa and New York and below last month's elsewhere. Levels were above long-term average in Minnesota, Illinois, and Michigan, and below average elsewhere. Level in a well in Ohio

NEW EXTREMES DURING AUGUST AT GROUND-WATER INDEX STATIONS

WRD Station Identification Number	Aquifer and Location	Aquifer type and local aquifer pumpage	Depth of well	Years of record	End-of-month water level in feet below land surface datum: Previous August Record: Average	Previous August Record: Extreme (year)	August 1991
	LOW WATER LEVELS						
	WESTERN MOUNTAIN RANGES						
463906112043901	Cretaceous aquifer near Helena, Montana	□	110	14	28.45	35.03 (1990)	36.57
	ALLUVIAL BASINS						
315212106245101	Hueco bolson aquifer at El Paso, Texas	●	640	26	253.54	271.88 (1990)	273.00
324340104231701	Roswell Basin shallow aquifer at Dayton, New Mexico	●	250	40	92.71	122.55 (1990)	123.00
361611115151301	Valley fill aquifer near Las Vegas, Nevada	■	905	45	36.37	101.82 (1990)	105.33
403803111505301	Basin fill aquifer near Holladay, Utah	■	165	12	75.06	90.30 (1990)	90.83
	COLUMBIA LAVA PLATEAU						
424053113412801	Snake River Plain aquifer near Rupert, Idaho	●	194	40	152.9	160.0 (1990)	164.6
425635114382301	Snake River Plain aquifer at Gooding, Idaho	○	165	19	131.8	141.9 (1978)	143.9
453934118491701	Columbia River basalts aquifer at Pendleton, Oregon	●	1,501	26	191.02	222.55 (1990)	[1]222.93
	COLORADO PLATEAU AND WYOMING BASIN						
352023107473201	Westwater Canyon aquifer near Grants-Bluewater, New Mexico	●	155	35	72.10	72.93 (1984)	78.87
	HIGH PLAINS						
341010102240801	Ogallala aquifer near Lubbock, Texas	●	202	40	56.26	90.15 (1990)	[1]92.30
392329101040201	Ogallala aquifer near Colby, Kansas	●	175	44	120.38	130.18 (1990)	[1]131.07
	NONGLACIATED CENTRAL REGION						
375039097234201	Sand and gravel Pleistocene aquifer near Valley Center, Kansas	●	54	54	17.12	20.01 (1956)	21.14
375810097324301	Equus aquifer near Halstead, Kansas	●	57	51	23.90	36.66 (1990)	39.90
465755102410701	Sentinel Butte aquifer near Dickinson, North Dakota	○	160	22	18.02	20.62 (1990)	[1]21.51
	GLACIATED CENTRAL REGION						
415534091251502	Canbrian-Ordovician aquifer at Mt. Vernon, Iowa	▩	1,557	4	335.69	337.61 (1990)	[1]341.08
	ATLANTIC AND GULF COASTAL PLAIN						
321945090152201	Sparta aquifer system at Jackson, Mississippi	■	852	46	255.87	309.99 (1990)	311.17
322357092341701	Sparta aquifer near Ruston, Louisiana	▩	703	17	233.28	236.46 (1990)	237.14
331438092411901	Sparta aquifer near El Dorado, Arkansas	■	540	37	335.05	354.78 (1990)	[1]371.40
335115079033500	Pee Dee aquifer at Collins Park at Conway, South Carolina	■	438	17	34.53	61.90 (1990)	63.29
364059076544901	Middle Potomac aquifer at Franklin, Virginia	■	305	31	170.25	208.08 (1990)	208.30
372506076511703	Upper Potomac aquifer near Toano, Virginia	●	401	6	157.82	161.66 (1990)	163.46
	HIGH WATER LEVELS						
	ALLUVIAL BASINS						
332615104303601	Roswell Basin artesian aquifer at Roswell, New Mexico	■	324	24	64.53	49.06 (1990)	45.70
	NONGLACIATED CENTRAL REGION						
324842097102901	Twin Mountains (Trinity) aquifer near Hurst/Fort Worth, Texas	▩	667	13	462.44	452.59 (1983)	445.71
	PIEDMONT AND BLUE RIDGE						
355359080331701	Weathered granite aquifer near Mocksville, North Carolina	○	31	9	20.18	16.62 (1984)	15.79
402644074563601	Stockton aquifer at Sergeantsville, New Jersey	○	21	20	15.10	13.09 (1989)	12.47
	SOUTHEAST COASTAL PLAIN						
313748084002901	Upper Floridan aquifer near Albany, Georgia	■	259	28	34.18	26.90 (1973)	26.38

[1] All-time month-end low.

tied the previous record August low, and an all-time low occurred in a well in the Cambrian-Ordovician aquifer at Mt. Vernon, Iowa.

Ground-water levels were at or below last month's throughout most of the Piedmont and Blue Ridge region except in New Jersey, where the level was above last month's. Levels were below long-term average in Maryland; above long-term averages in New Jersey and North Carolina; and mixed in Pennsylvania, Virginia, and Georgia. August highs occurred in wells in New Jersey and North Carolina.

In the Northeast and Superior Uplands region, levels were at or above last month's in Maine and Connecticut, mixed in New Hampshire and below last month's levels elsewhere in the region. Water levels were below average in Michigan and Massachusetts; mixed in New Hampshire and Vermont; and at or above long-term average elsewhere.

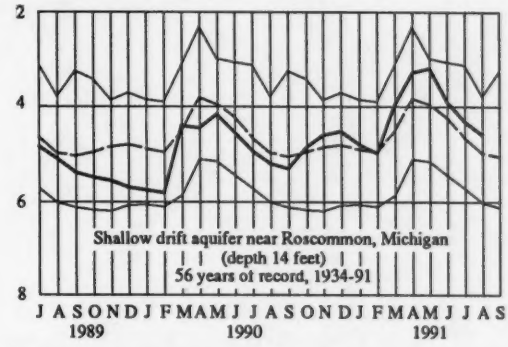
In the Atlantic and Gulf Coastal Plain region, water levels were above last month's in Delaware, North Carolina, and Texas; mixed in New Jersey, Virginia, and Louisiana; and below last month's levels elsewhere. Ground-water levels were above long-term averages in Kentucky and Texas; mixed with respect to average in New Jersey, Georgia, and Louisiana; and below average elsewhere. August lows occurred in wells in Virginia, South Carolina, Mississippi, and Louisiana. All-time lows occurred in wells in the Upper Potomac aquifer near Toano, Virginia, and the Sparta aquifer near El Dorado, Arkansas.

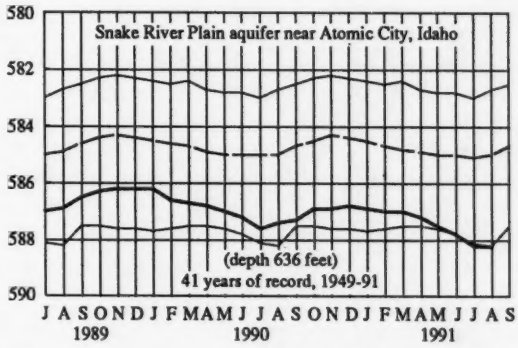
In the Southeast Coastal Plain region, water levels were mixed with respect to last month's levels and also with respect to long-term averages throughout the region.

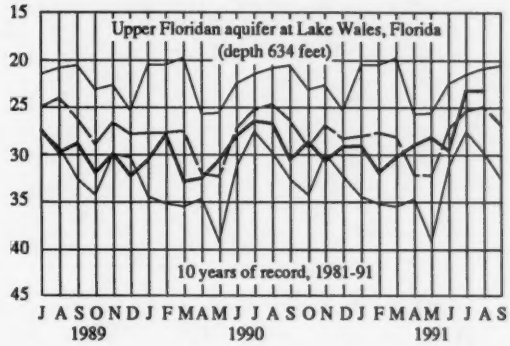
MONTHEND GROUND-WATER LEVELS IN SELECTED WELLS

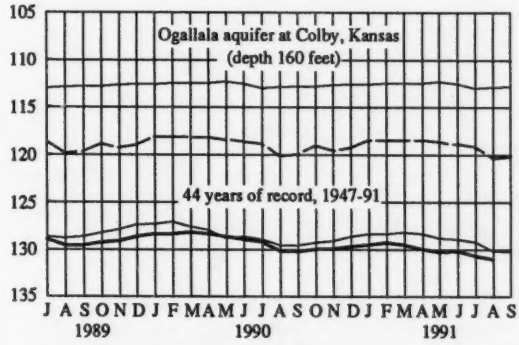
Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates average of monthly levels in previous years. Heavy line indicates level for current period.

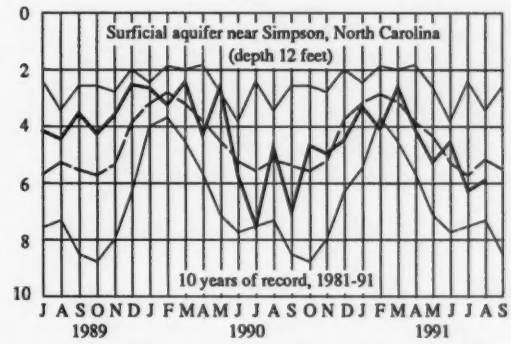
WATER LEVEL, FEET BELOW LAND-SURFACE DATUM

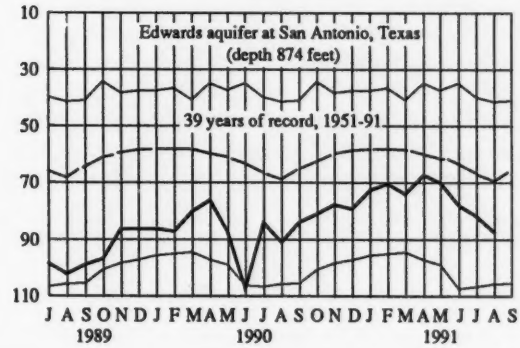

Shallow drift aquifer near Roscommon, Michigan
(depth 14 feet)
56 years of record, 1934-91
J A S O N D J F M A M J J A S O N D J F M A M J J A S
1989
1990
1991

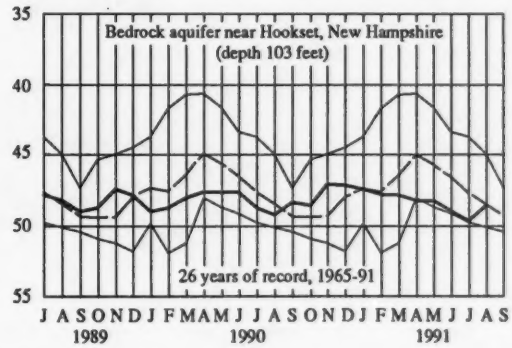

Snake River Plain aquifer near Atomic City, Idaho
(depth 636 feet)
41 years of record, 1949-91
J A S O N D J F M A M J J A S O N D J F M A M J J A S
1989
1990
1991

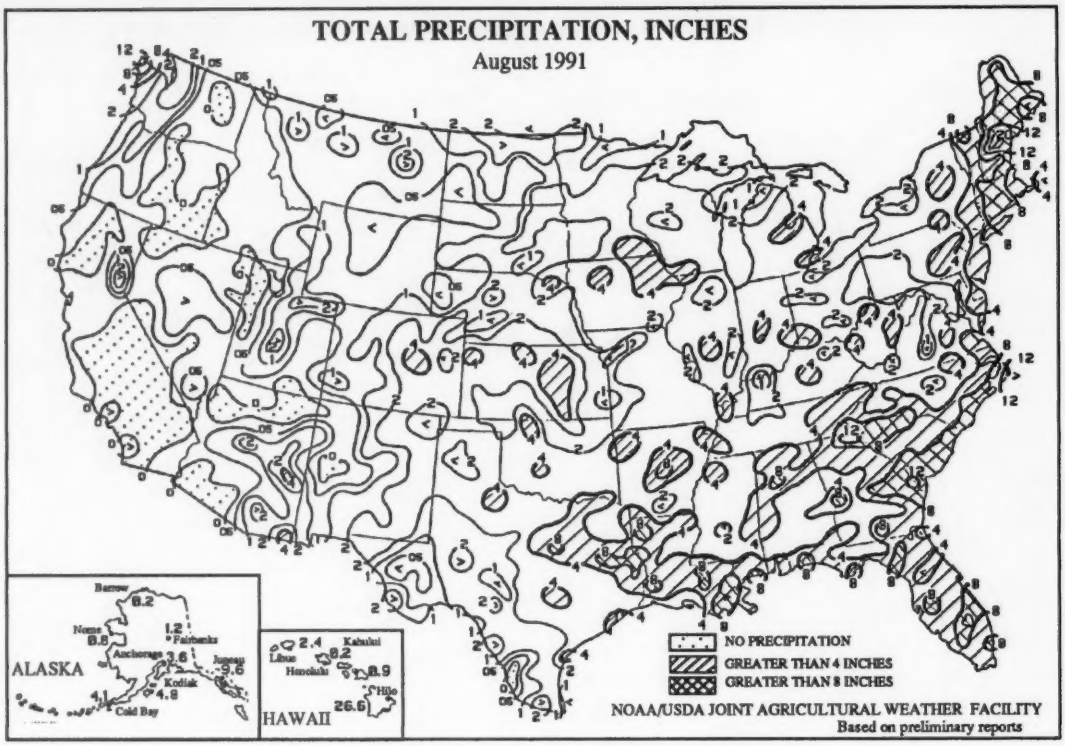

Upper Floridan aquifer at Lake Wales, Florida
(depth 634 feet)
10 years of record, 1981-91
J A S O N D J F M A M J J A S O N D J F M A M J J A S
1989
1990
1991

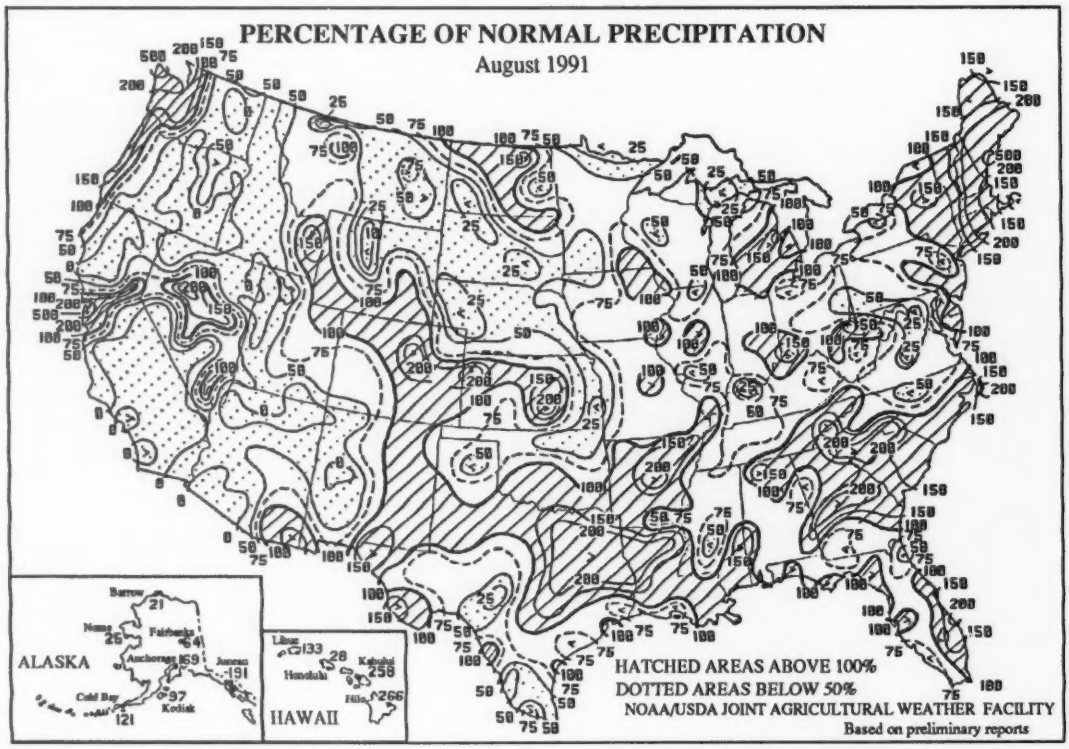

Ogallala aquifer at Colby, Kansas
(depth 160 feet)
44 years of record, 1947-91
J A S O N D J F M A M J J A S O N D J F M A M J J A S
1989
1990
1991


Surficial aquifer near Simpson, North Carolina
(depth 12 feet)
10 years of record, 1981-91
J A S O N D J F M A M J J A S O N D J F M A M J J A S
1989
1990
1991


Edwards aquifer at San Antonio, Texas
(depth 874 feet)
39 years of record, 1951-91
J A S O N D J F M A M J J A S O N D J F M A M J J A S
1989
1990
1991


Bedrock aquifer near Hookset, New Hampshire
(depth 103 feet)
26 years of record, 1965-91
J A S O N D J F M A M J J A S O N D J F M A M J J A S
1989
1990
1991

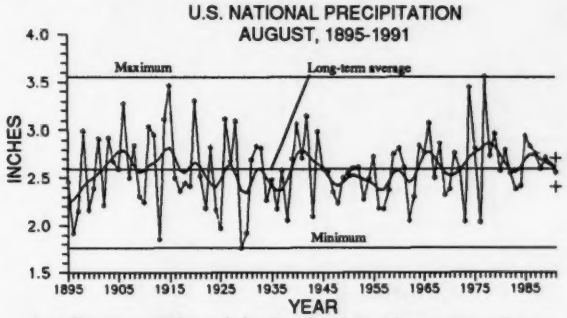




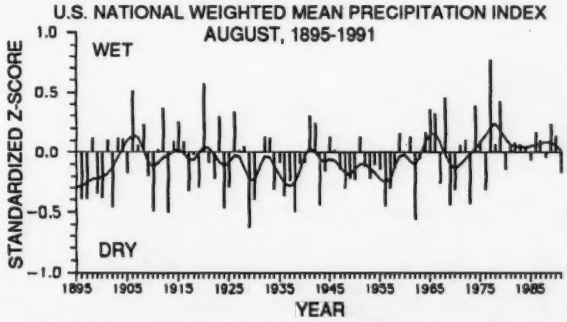
(From *Weekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Weather Facility)

UNITED STATES AUGUST CLIMATE IN HISTORICAL PERSPECTIVE

Preliminary data for August 1991 indicate that temperature averaged across the contiguous United States was slightly above the long-term mean. August 1991 ranked as the 16th warmest August on record (the record begins in 1895). The 1991 value is based on preliminary data, which has been shown to be within 0.26 °F of the final data over a 31-month period. Roughly 25 percent of the country averaged much above normal for August 1991, with only 2.5 percent averaging much below normal.



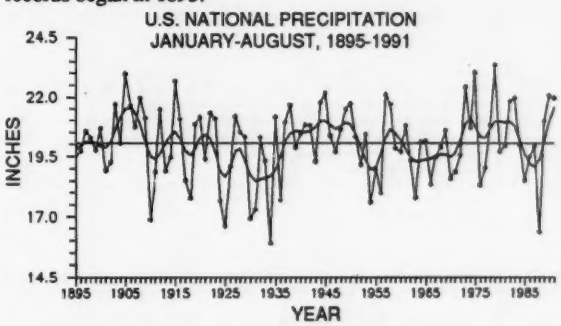
Areally-averaged precipitation for the nation was nearly normal for August (graph above), which ranked August 1991 as the 54th wettest (43rd driest) August on record. The preliminary value for precipitation is estimated to be accurate to within 0.15 inches and the confidence interval is plotted above as a '+'. About one-tenth (10.7%) of the country experienced much wetter than normal conditions and thirteen percent was much drier than normal.



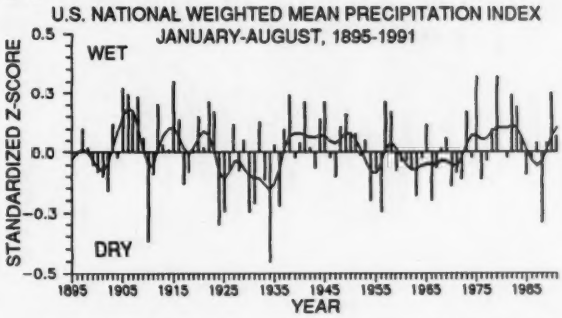
Historical precipitation is shown in a different way in the graph above. The August precipitation for each climate division in the contiguous U.S. was first standardized using the gamma distribution over the 1951-80 period. These gamma-standardized values were then weighted by area and averaged to determine a national standardized precipitation value. Negative values are dry, positive are wetter than the mean. This index gives a more accurate indication of how precipitation across the country compares to the local normal climate. The areally-weighted mean standardized national precipitation ranks 1991 as the 63rd wettest (35th driest) August on record.

Precipitation rankings had a patchwork design with no distinct pattern detectable. The Northeast had the seventh wettest August on record with much of that thanks to Hurricane Bob and an active upper level flow over New England. The West and South were the only other regions in the upper third of the historical distribution recording their 27th and 18th wettest August respectively. Within the lower third of the distribution, we find the Southwest region (31st driest), Central region (29th driest), East North Central region (26th driest), and the West North Central region which had the eighth driest August on record. For the entire nation, August was on the dry side and warm having the 43rd driest and 82nd hottest August since records began in 1895.

The year so far, for the nation as a whole, has been unusually warm, with January-August 1991 ranking as the sixth warmest January-August period on record. About 43 percent of the country has been very warm when compared to the normal, while less than one percent of the country (0.6%) has averaged very cold thus far this year. Three states—Connecticut, Maryland, and Virginia—had their warmest January-August since records began in 1895.

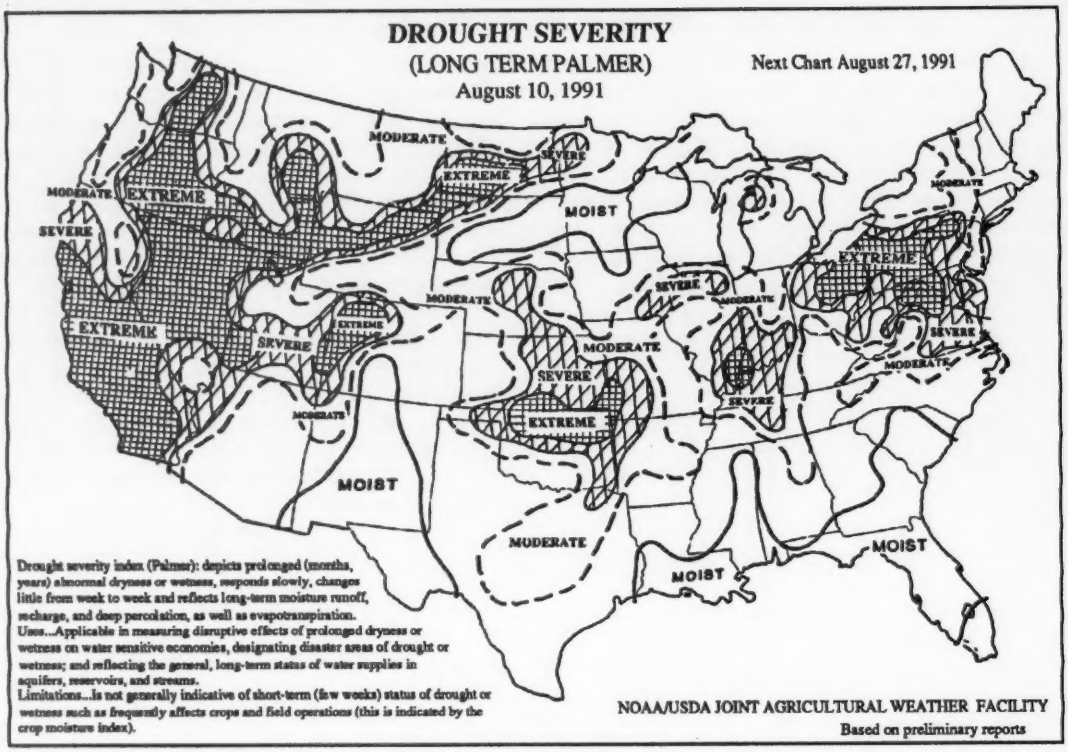


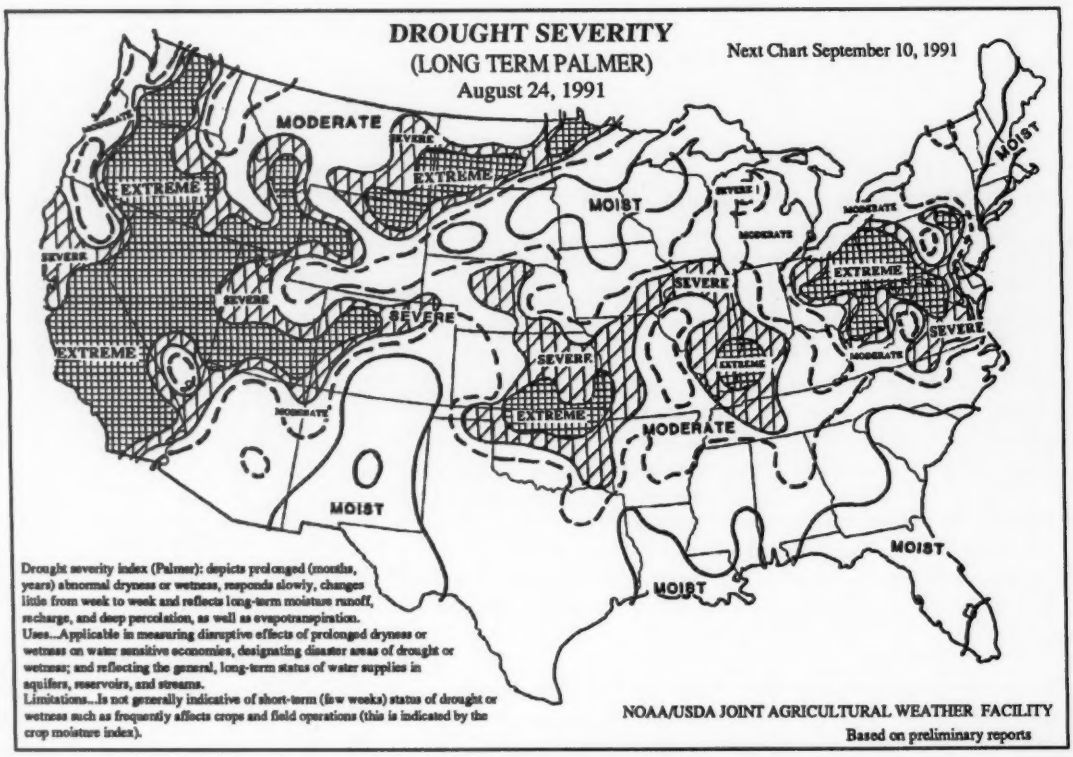
For the nation, the period January-August 1991 shows areally-averaged precipitation above normal, ranking as the eleventh wettest (87th driest) such period on record (graph above). When the local normal climate is taken into account, however, 1991 ranked as the 34th wettest January-August period on record. (See graph below.)



About 8.4% of the nation suffered from much below normal precipitation for the January through August period while 15.6% percent experienced much above normal rainfall. Three states had their seventh driest or drier year-to-date (Maryland, Ohio, and Pennsylvania). At the other extreme, three states—Florida, Louisiana, and Mississippi—had their wettest January through August period on record.

(From *Climate Variations Bulletin*, National Climatic Data Center, NOAA)


DROUGHT SEVERITY
(LONG TERM PALMER)
August 10, 1991
Next Chart August 27, 1991
MODERATE
SEVERE
EXTREME
MOIST
Drought severity index (Palmer): depicts prolonged (months, years) abnormal dryness or wetness, responds slowly, changes little from week to week and reflects long-term moisture runoff, recharge, and deep percolation, as well as evapotranspiration.
Uses...Applicable in measuring disruptive effects of prolonged dryness or wetness on water sensitive economies, designating disaster areas of drought or wetness; and reflecting the general, long-term status of water supplies in aquifers, reservoirs, and streams.
Limitations...Is not generally indicative of short-term (few weeks) status of drought or wetness such as frequently affects crops and field operations (this is indicated by the crop moisture index).
NOAA/USDA JOINT AGRICULTURAL WEATHER FACILITY
Based on preliminary reports


DROUGHT SEVERITY
(LONG TERM PALMER)
August 24, 1991
Next Chart September 10, 1991
MODERATE
SEVERE
EXTREME
MOIST
Drought severity index (Palmer): depicts prolonged (months, years) abnormal dryness or wetness, responds slowly, changes little from week to week and reflects long-term moisture runoff, recharge, and deep percolation, as well as evapotranspiration.
Uses...Applicable in measuring disruptive effects of prolonged dryness or wetness on water sensitive economies, designating disaster areas of drought or wetness; and reflecting the general, long-term status of water supplies in aquifers, reservoirs, and streams.
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Based on preliminary reports

(From *Weekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Weather Facility)

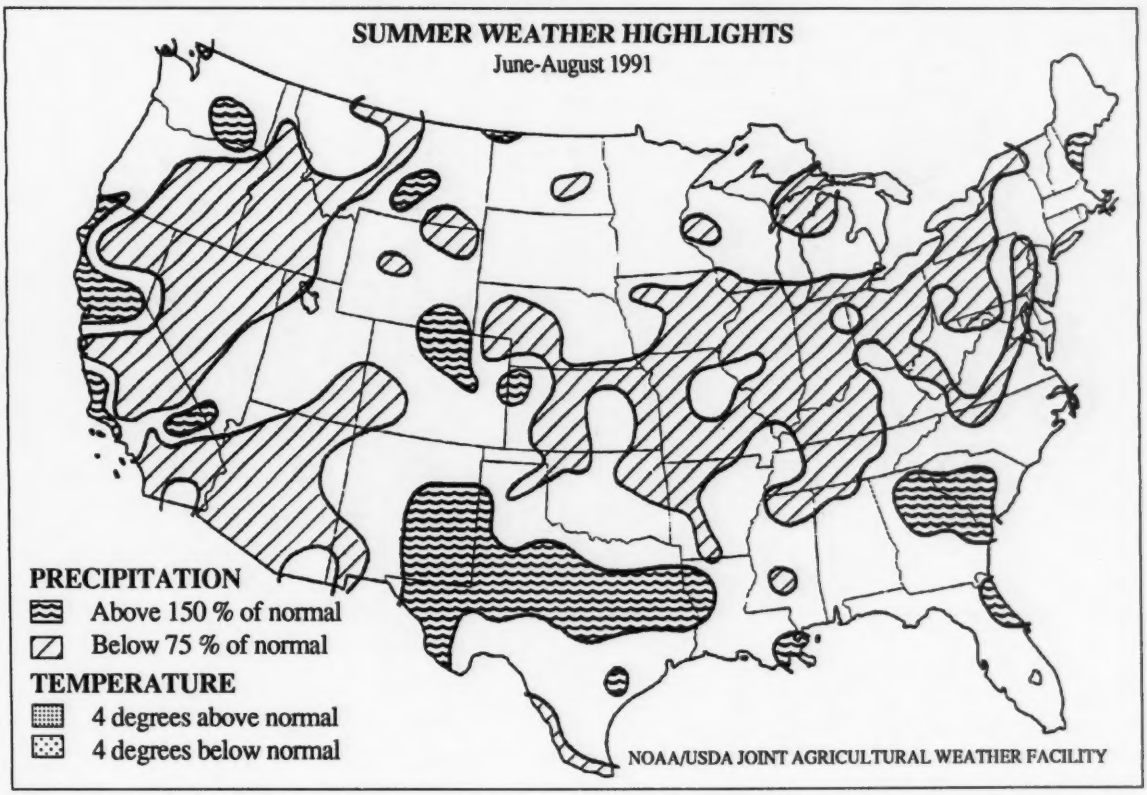
AUGUST WEATHER SUMMARY

August 1991 got mixed reviews nationwide. Lazy summer frontal boundaries brought the wettest weather since May to parts of the Corn Belt and central Plains. Farther west and south, a wetter-than-normal region arced from the central Rockies to the Southeast. Hurricane Bob accounted for most of the rainfall excesses in the Northeast. Elsewhere, precipitation deficits mounted in the mid-Atlantic region, and dryness persisted from the Nebraskan Plains northwestward. In the West, a mid-month storm dropped unusual moisture from central California to the Great Basin. A pair of late-month storms contributed heavily toward rainfall totals in the Pacific Northwest.

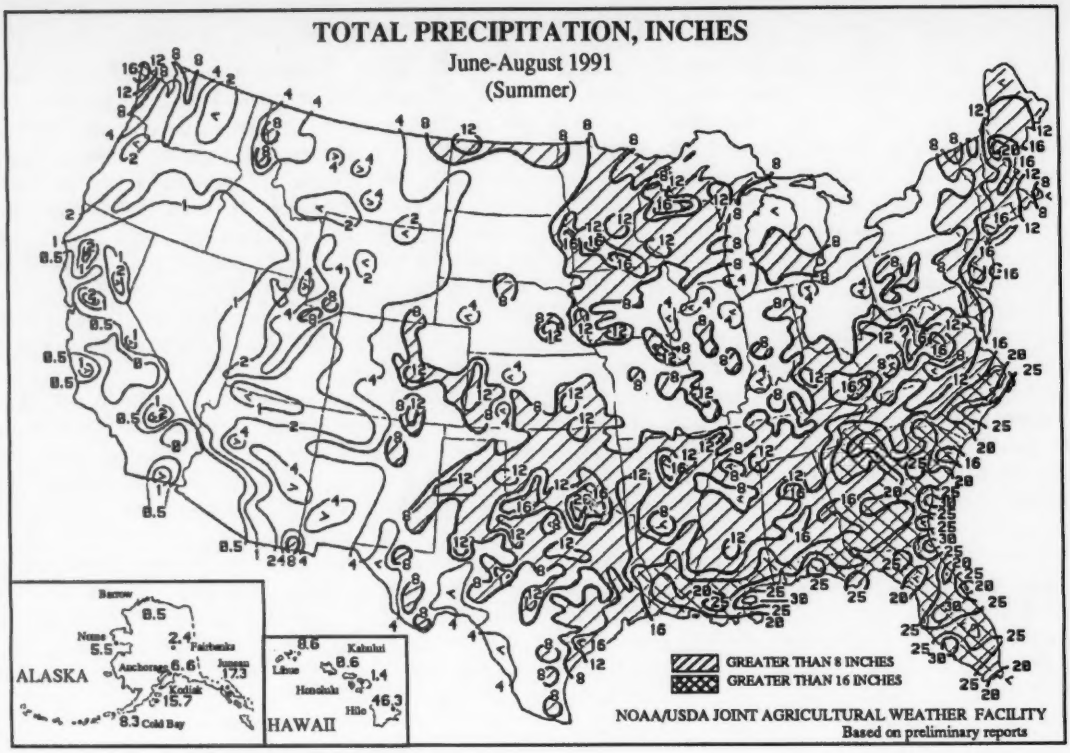
Across the Nation's northern tier, unusual heat accompanied the often dry conditions. Temperature departures exceeded +4 °F from southern Idaho to northern Minnesota. In the South, extensive cloud cover, wet ground, and rainfall depressed temperatures to near- or below-normal. Upper air low pressure systems off the West coast held temperatures slightly below normal in interior California.

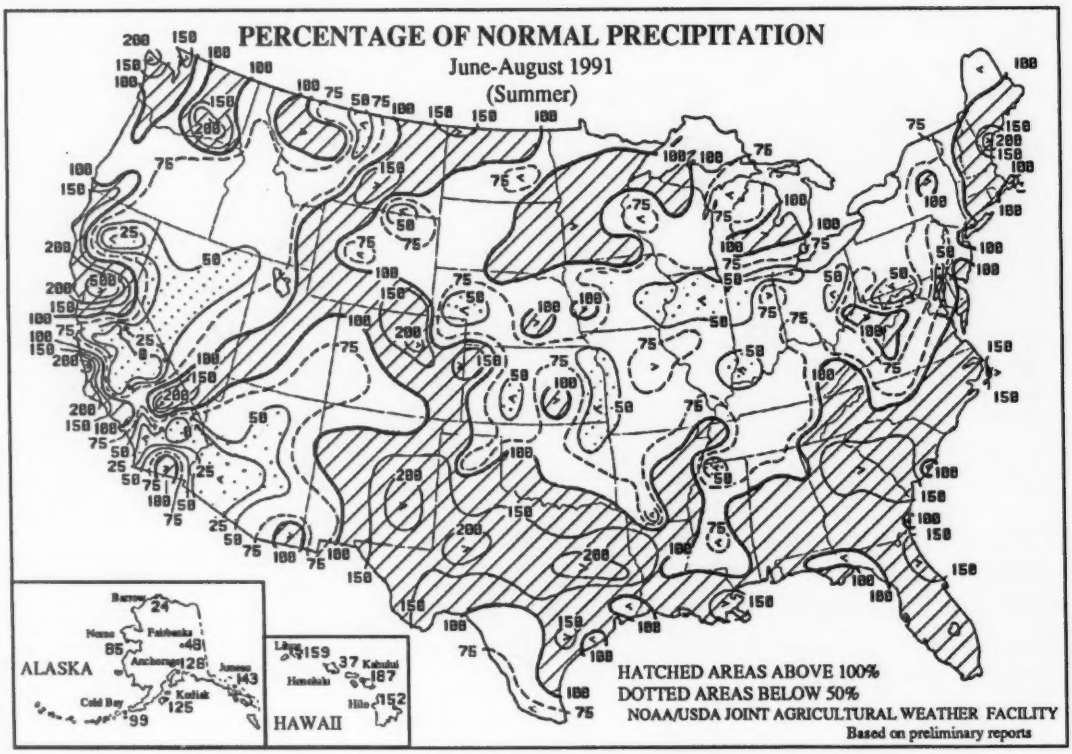
An airmass battle kept thunderstorms active from the Corn Belt southward in early August. The boundary between Canadian and subtropical air punched through the Northeast, dropping only showers, but loitered across the Midwest for several days, dumping locally heavy rain. The Canadian high pressure system conquered after the 10th, shifting heavy rainfall into the South. After mid-August, the influence of two tropical systems changed the rainfall pattern. The remnants of eastern Pacific Tropical Storm Hilda linked with an encroaching Canadian cold front to produce rain from central California to the Corn Belt. Hurricane Bob struck the densely populated coastal Northeast, causing extensive wind and flood damage from southeastern New York to Maine. Bob's rains were followed by additional significant thunderstorms in New England. Convection became far more scattered after the 20th, primarily plaguing the South. As cool weather settled across the Northeast toward month's end, a late summer heat wave waxed in the Southwest and spread eastward. Temperatures regularly reached 100 °F in the northern Plains during the final week of August.

Boosted by a 7.83-inch rainfall from Hurricane Bob, Portland, ME, notched its wettest month ever (15.22 inches; former record was 13.50 inches in November 1983). Shreveport, LA, returned to the weather headlines with its third wettest August (9.23 inches), which leaves the city less than 4 inches shy of an all-time wettest year. Yearly precipitation in New Orleans, LA, rose to 92.23 inches by the end of the month. The normal annual total is 59.74 inches. The monthly average temperature of 72.8 °F in Helena, MT, was 0.6 °F higher than in August 1929, the previous hottest August on record. In the East, one remarkable streak remained intact: Raleigh, NC, recorded its 20th consecutive warmer-than-normal month.



(From *Weekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Weather Facility)

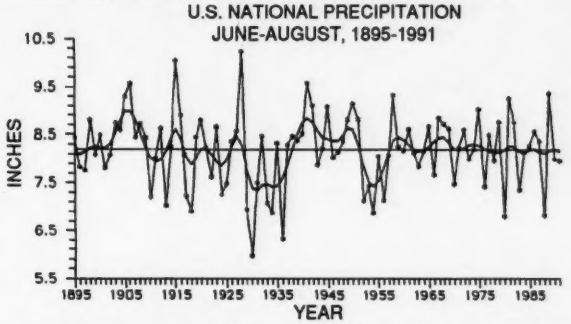




(From *Weekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Weather Facility)

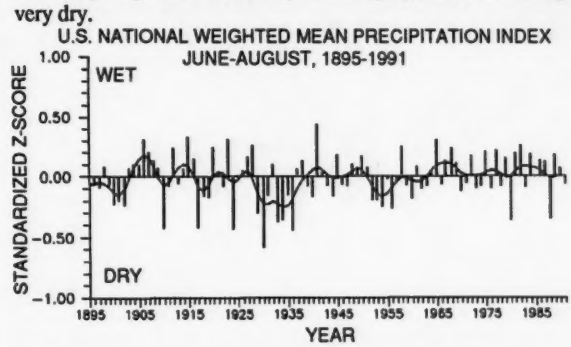
UNITED STATES SUMMER CLIMATE IN HISTORICAL PERSPECTIVE

Preliminary data for Summer 1991 indicate that temperature averaged across the contiguous United States was above the long-term mean, ranking this summer as the nineteenth warmest summer (June-August) on record (the record begins in 1895). About 16% of the nation had average summer temperatures in the very warm category, while 2% averaged very cold. The filtered curve (not shown) suggests that the summers of the last several years have averaged about as warm as those of the mid-1950's but considerably cooler than the summers of the mid-1930's.



Areally-averaged precipitation for the nation was slightly below the long-term mean (graph above), with Summer 1991 ranking as the 29th driest summer on record.

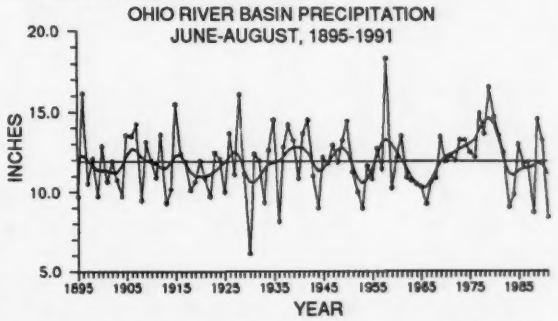
Historical precipitation is shown in a different way in the graph below. The summer precipitation for each climate division in the contiguous U.S. was first standardized using the gamma distribution over the 1951-80 period. These gamma-standardized values were then weighted by area and averaged to determine a national standardized precipitation value. Negative values are dry, positive are wetter than the mean. This index gives a more accurate indication of how precipitation across the country compares to the local normal climate. The areally-weighted mean standardized national precipitation ranks Summer 1991 as the 42nd driest summer on record. There was considerable variation of precipitation on a regional basis, with about 12% of the nation having summer precipitation in the very wet category and 15% ranking very dry.



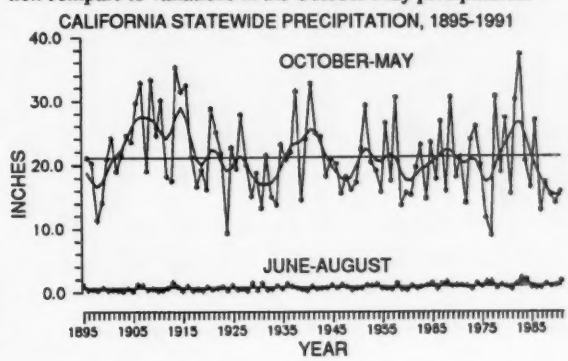
Temperatures followed a simple pattern with the southwestern half of the country having temperatures ranking in the middle third of the historical distribution and the northeastern half ranking in the warm third of the distribution. The Northeast region had the warmest relative ranking at eighth warmest (90th coldest). Conditions were relatively dry in the East North Central, Northeast, and Central regions, with the latter region having the fifth driest summer on record. The Southeast, West, and Northwest regions ranked in the wet third of the distribution.

Eight states (Arizona, Illinois, Indiana, Maryland, New York, Ohio, Pennsylvania, and West Virginia) had the tenth driest, or drier, summer on record in 1991, with Ohio ranking as second driest. Two states ranked in the top ten wettest, including California which ranked as fourth wettest. One state (New Mexico) ranked in the tenth coldest, or colder, category, while ten states fell in the tenth warmest, or warmer, category for summer temperature.

The Ohio river basin, which drains a large part of the Central region, was especially dry during the summer 1991, recording the third driest summer on record. This is drier than the summer of 1988 but not as dry as the drought summers of the 1930's. (See graph below). The Primary Corn and Soybean agricultural belt, which covers much of the Central region but includes a large area to the west, had the ninth driest summer on record in 1991. This was not as dry as the drought summer of 1988.

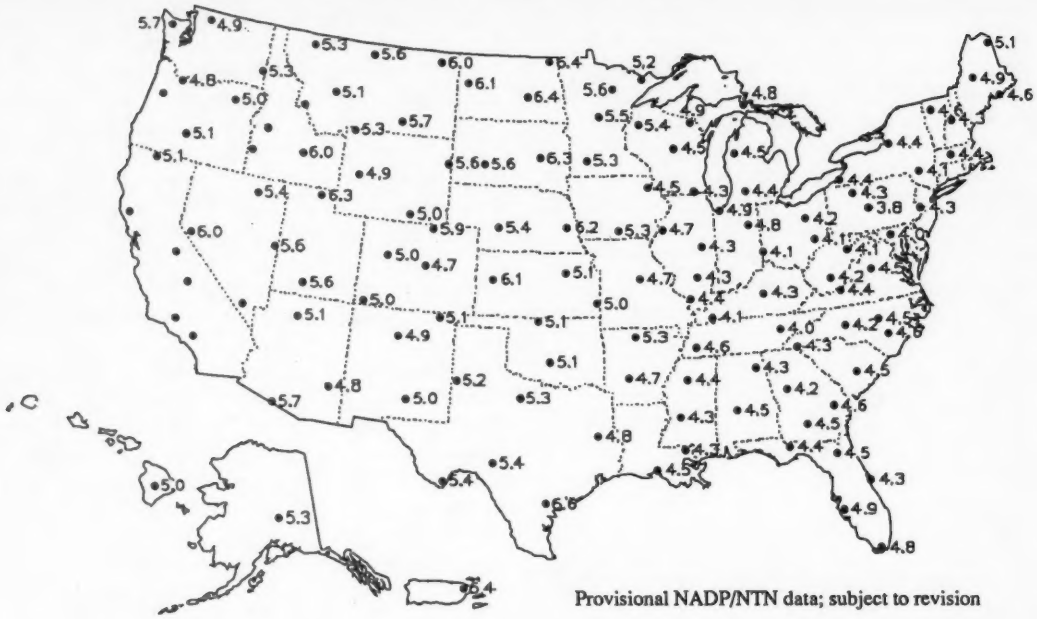


California had the fourth wettest summer on record in 1991. In order to make any meaningful conclusions, however, this rank must be put into climatological perspective. The state is in the midst of a five-year drought. Since most of the precipitation occurs during the winter half of the year, a wet summer will have a very minor effect on the long-term moisture conditions. The graph below shows how variations in the June-August precipitation compare to variations in the October-May precipitation.



(From *Climate Variations Bulletin*, National Climatic Data Center, NOAA)

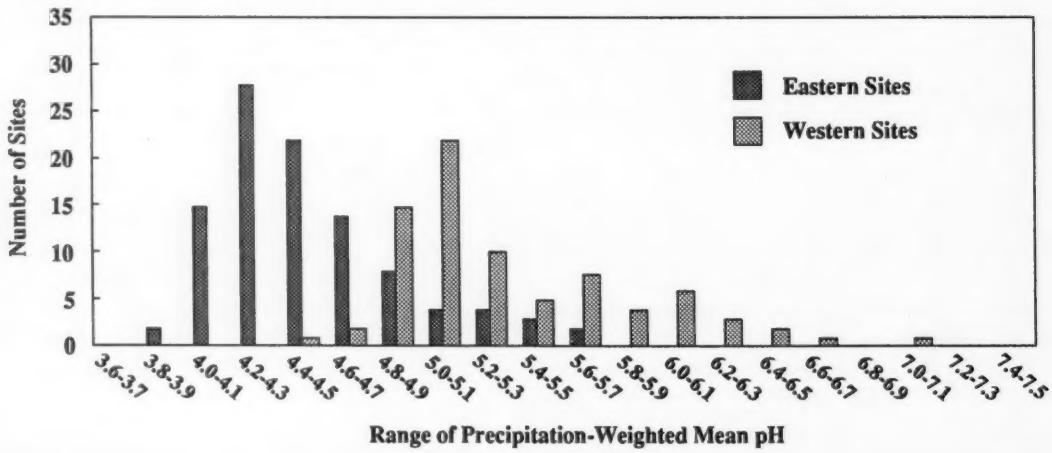
pH of Precipitation for July 22-August 25, 1991



Current pH data shown on the map (• 4.9) are precipitation-weighted means calculated from preliminary laboratory results provided by the NADP/NTN Central Analytical Laboratory at the Illinois State Water Survey and are subject to change. The 128 points (•) shown on this map represent a subset of all sites chosen to provide relatively even geographic spacing. Absence of a pH value at a site indicates either that there was no precipitation or that data for the site did not meet preliminary screening criteria for this provisional report.

A list of the approximately 200 sites comprising the total Network and additional data for the sites are available from the NADP/NTN Coordination Office, Natural Resource Ecology Laboratory, Colorado State University, Fort Collins, CO 80523.

Distribution of precipitation-weighted mean pH for all NADP/NTN sites having one or more weekly samples for July 22-August 25, 1991. The East/West dividing line is at the western borders of Minnesota, Iowa, Missouri, Arkansas, and Louisiana.



TEMPERATURE OUTLOOK FOR SEPTEMBER-NOVEMBER 1991

PRECIPITATION OUTLOOK FOR SEPTEMBER-NOVEMBER 1991

From *Monthly and Seasonal Weather Outlook* prepared and published by the National Weather Service

NATIONAL WATER CONDITIONS

AUGUST1991

Based on reports from the Canadian and U.S. Field offices; completed September 27, 1991

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EXPLANATION OF DATA (Revised December 1990)

Cover map shows generalized pattern of streamflow for the month based on provisional data from 186 index gaging stations—18 in Canada, 166 in the United States, and 2 in the Commonwealth of Puerto Rico. Alaska, Hawaii, and Puerto Rico inset maps show streamflow only at the index gaging stations that are located near the point shown by the arrows. Classifications on map are based on comparison of streamflow for the current month at each index station with the flow for the same month in the 30-year reference period, 1951-80. Shorter reference periods are used for one Canadian index station, two Kansas index stations, and the Puerto Rico index stations because of the limited records available.

The ***streamflow ranges map*** shows where streamflow has persisted in the above- or below-normal range from last month to this month and also where streamflow is in the above- or below-normal range this month after being in a different range last month. Three ***pie charts*** show: the percent of stations reporting discharges in each flow range for both the conterminous United States and southern Canada, and also the percent of area in each flow range for the conterminous United States and southern Canada. The ***combination bar/line graph*** shows the percent departure of the total mean from the total median flow (1951-80) and the cumulative departure from median (in cfs) for all reporting stations (excluding eight large river stations indicated by * in the ***Flow of large rivers*** table) in the conterminous United States and southern Canada.

The comparative data are obtained by ranking the 30 flows for each month of the reference period in order of decreasing magnitude—the highest flow is given a ranking of 1 and the lowest flow is given a ranking of 30. Quartiles (25-percent points) are computed by averaging the 7th and 8th highest flows (upper quartile), 15th and 16th highest flows (middle quartile and median), and the 23rd and 24th highest flows (lower quartile). The upper and lower quartiles set off the highest and lowest 25 percent of flows, respectively, for the reference period. The median (middle quartile) is the middle value by definition. For the reference period, 50 percent of the flows are greater than the median, 50 percent are less than the median, 50 percent are between the upper and lower quartiles (in the normal range), 25 percent are greater than the upper quartile (above normal), and 25 percent are less than the lower quartile (below normal). Flow for the current month is then classified as: in the ***above-normal range*** if it is greater than the upper quartile, in the ***normal range*** if it is between the upper and lower quartiles, and in the ***below-normal range*** if it is less than the lower quartile. Change in flow from the previous month to the current month is classified as ***seasonal*** if the change is in the same direction as the change in the median. If the change is in the opposite direction of the change in the median, the change is classified as ***contraseasonal*** (opposite to the seasonal change). For example: at a particular index station, the January median is greater than the December median; if flow for the current January increased from December (the previous month), the increase is seasonal; if flow for the current January decreased from December, the decrease is contraseasonal.

Flood frequency analyses define the relation of flood peak magnitude to probability of occurrence or recurrence interval. ***Probability of occurrence*** is the chance that a given flood magnitude will be exceeded in any one year. ***Recurrence interval*** is the reciprocal of probability of occurrence and is the average number of years between occurrences. For example, a flood having a probability of occurrence of 0.01 (1 percent) has a recurrence interval of 100 years. ***Recurrence intervals imply no regularity of occurrence***; a 100-year flood might be exceeded in consecutive years or it might not be exceeded in a 100-year period.

Statements about ***ground-water levels*** refer to conditions near the end of the month. The water level in each observation well is compared with average level for the end of the month determined from the entire period of record for that well. ***Changes in ground-water levels***, unless described otherwise, are from the end of the previous month to the end of the current month.

Dissolved solids and temperature data are given for five stream-sampling sites that are part of the National Stream Quality Accounting Network (NASQAN). ***Dissolved solids*** are minerals dissolved in water and usually consist predominately of silica and ions of calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, and nitrate. ***Dissolved-solids discharge*** represents the total daily amount of dissolved minerals carried by the stream. ***Dissolved-solids concentrations*** are generally higher during periods of low streamflow, but the highest dissolved-solids discharges occur during periods of high streamflow because the total quantities of water, and therefore total load of dissolved minerals, are so much greater than at times of low flow.

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